

Pro Dev Office
Anty
HURRICANE PROTECTION PROJECT

NEW LONDON

HURRICANE PROTECTION

NEW LONDON, CONNECTICUT

DESIGN MEMORANDUM NO. 2

GENERAL DESIGN

(REVISED)



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

JULY 1977



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:

NEDED-E

28 July 1977

SUBJECT: New London Hurricane Protection Project, New
London, Connecticut

HQDA (DAEN-CWE-B)
WASH DC 20314

1. References:

- a. ER 1110-2-1150 - Engineering and Design
Post Authorization Studies
- b. EC 1105-2-501 - Environmental Impact Statement dated
17 April 1972 - Review Procedures

2. In accordance with reference 1. a., there is submitted for review and approval Design Memorandum No. 2 (Revised) General Design for the New London Hurricane Protection Project.

3. This Memorandum reflects revisions, modifications and changes developed subsequent to the approval of Design Memorandum No. 2 dated 12 January 1966, and a supplemental report to the authorized project dated June 1976, used for reauthorization. Outline of changes to the design and benefits are described in the text of the report.

4. The benefit to cost ratio 1.2 to 1 is based on the discount rate of 6-1/8 percent.

5. Section T of this Memorandum presents the statement of findings prepared in accordance with reference 1. b.

6. A revised draft of the EIS was placed on file with CEQ on 30 July 1975 and a Final Impact Statement was filed with CEQ on 25 August 1976.

NEDED-E

28 July 1977

SUBJECT: New London Hurricane Protection Project, New
London, Connecticut

7. Since the new development in the Urban Renewal area is being stymied until the pressure conduit is installed, the City of New London is anxious to install the 96" conduit as soon as possible from Garibaldi Square along Bank Street to the Cove. The City of New London has engaged the services of an A-E to design this portion of the conduit for them in accordance with Corps criteria. The A-E's report, design and estimate are inclosed in Appendix C. Upon approval of this DM, it is this Division's intent to review the plans and specifications for the conduit and issue for bids a Phase I construction contract.

8. It is recommended that the project plan providing hurricane protection for the City of New London be approved as the basis of preparing plans and specifications. It is further recommended that a Phase I construction contract for a segment of the 96" pressure conduit be approved.

FOR THE DIVISION ENGINEER:



GEORGE T. SARANDIS
Acting Chief, Engineering Division

2 Incl (14 cys ea)

1. Gen Des Memo #2 Rev.
2. Environmental Impact
Statement

NEW LONDON HURRICANE PROTECTION PROJECT

NEW LONDON, CONNECTICUT

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<u>No.</u>	<u>Title</u>	Anticipated Submission <u>Date</u>	<u>Date Submitted</u>	<u>Date Approved</u>
1	Hurricane Tidal Hydraulics		15 Oct 65	14 Jan 66
2	General Design (Incl Site Geology)		12 Jan 66	15 Mar 66
2	General Design (Revised)		Jul 77	
3	Concrete Materials		2 Nov 65	16 Dec 65
4	Real Estate		2 Mar 70	1 May 70
5	Bentleys Creek Barrier		10 Mar 70	1 Jun 70
6	Embankments and Foundations Structures, Cathodic Protection	Jan 78	Oct 77	

NEW LONDON HURRICANE PROTECTION PROJECT

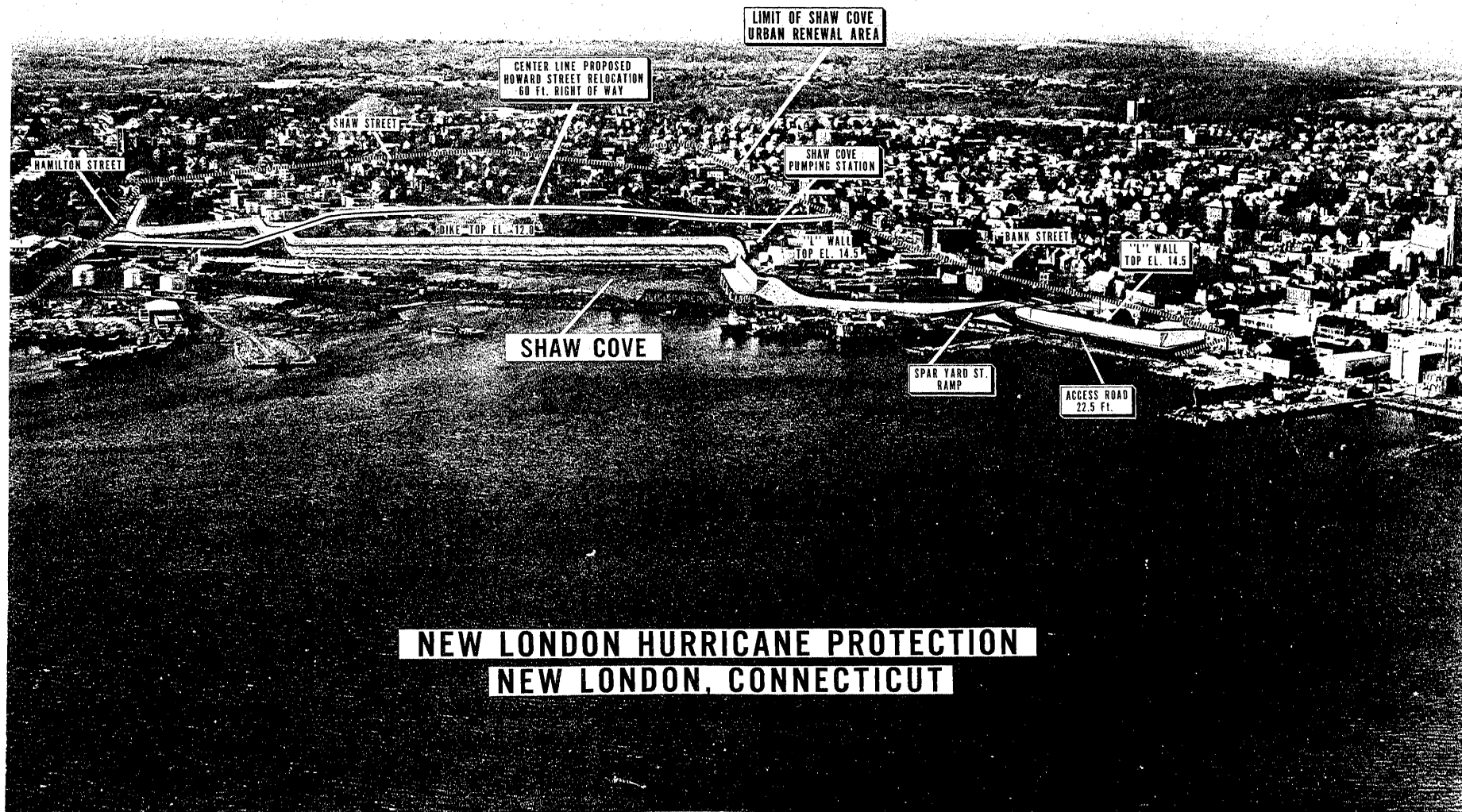
NEW LONDON, CONNECTICUT

DESIGN MEMORANDUM NO. 2 (REVISED)

GENERAL DESIGN

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

JULY 1977



NEW LONDON HURRICANE PROTECTION PROJECT
NEW LONDON, CONNECTICUT

DESIGN MEMORANDUM NO. 2 (REVISED)

GENERAL DESIGN

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NEW LONDON HURRICANE PROTECTION PROJECT

NEW LONDON, CONNECTICUT

A. PERTINENT DATA

1. Purpose Hurricane Tidal Protection

2. Location of Project

State	Connecticut
County	New London
City	New London

3. Drainage Areas

Shaw Cove	755 Acres
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4. Embankments

Type	Earth Fill with Rock Toes and Facing
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Elevation, Top of Embankment	14.5 m. s.l. & El. 12.0
------------------------------	-------------------------

Length	2650 ft.
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Maximum Height	10.0 feet to 11.5 feet
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Side Slopes	1 on 2
-------------	--------

Top Width	Varies
-----------	--------

5. Walls

1. Reinforced Concrete L-Wall

Top Elevation	+14.5 m. s.l.
Base Elevation	+ 3.5 m. s.l.
Length	550 feet

2. I-Wall

Top Elevation	+14.5 m. s.l.
Length	220 feet

6. Pumping Stations

Structure	Reinforced Concrete Superstructure with Brick Facade
Pumps (3)	Vertical Axial Flow
Power Units	Diesel Engine
Pumping Capacity	210 c. f. s.

7. Principal Quantities

Embankment	
Excavation, Land Areas	37,800 c. y.
Impervious Fills	65,500 c. y.
Dumped Rock Fill	10,700 c. y.
Gravel	7,500 c. y.
Sand	14,000 c. y.
Armor Stone	4,000 c. y.
Dredging	12,000 c. y.
Concrete, Reinforced	1,300 c. y.
Walls, Z-Piling	14,300 s. f.
Circular Cells, Sheet Pile	21,000 s. f.
Granular Cell Fill	3,400 c. y.

8. Estimated Project Cost

Lands and Damages		\$ 970,000
Relocations		
Utilities		45,000
Construction		
Levees & Floodwalls	3,200,000	
Pumping Station	1,050,000	
Pressure Conduit	<u>1,620,000</u>	
Sub Total		5,870,000
Engineering & Design		615,000
Supervision & Administration		<u>500,000</u>
Total Project Cost		\$8,000,000

Federal Contribution

\$5,600,000

Local Contribution 30%

2,400,000

ECONOMIC ANALYSIS

Annual Benefits \$663,300

Annual Costs \$531,000

Benefit to Cost Ratio 1.2

CONSTRUCTION PERIOD 2 Years

HURRICANE FLOOD PROTECTION PROJECT

NEW LONDON, CONNECTICUT

DESIGN MEMORANDUM NO. 2 (Revised)

GENERAL DESIGN

JULY 1977

B. AUTHORIZATION

1. Authorization. The project for hurricane-flood control protection at New London, Connecticut, authorized by the Flood Control Act of 1962 (76 Stat. 1180) was modified by the Water Resources Development Act of 1976 (P. L. 94-587) dated 22 October 1976, to delete the Powder Island Bentleys Creek hurricane protection barrier; and authorized construction of the Shaw Cove hurricane protection barrier, pressure conduit, and pumping station works substantially in accordance with the revised plan, "New London Hurricane Protection" dated June 1976, on file in the Office of the Chief of Engineers and estimated to cost \$7,745,000; with such modifications as the Chief of Engineers may deem advisable.

2. Requirements of Local Cooperation. The requirements of local cooperation as contained in Public Law 94 587 read as follows:

"(b) Prior to initiation of construction of the project, appropriate non-Federal interests shall agree - -

(1) to provide without cost to the United States all lands, easements, and rights-of-way necessary for construction and operation of the project;

(2) to hold and save the United States free from damage due to construction, operation and maintenance of the project not including damages due to the fault or negligence of the United States or its contractors;

(3) to accomplish without cost to the United States all modifications or relocations of existing sewerage and drainage facilities, buildings, utilities, and highways made necessary by construction of the project not to include sewerage and drainage facilities at the line of protection.

(4) to maintain and operate all features of the project after completion in accordance with regulations prescribed by the Secretary of the Army; and

(5) to bear 30 per centum of the total first cost.

(c) Notwithstanding subsection (b) of this section or any other provision of law, non-Federal interests shall bear no part of the cost of any design for this project rejected or otherwise not accepted by such interests prior to the date of enactment of this section."

3. Status of Project. There is no prior project for protection against tidal flooding. The Hurricane Protection Project for the City of New London is under design.

C. LOCAL COOPERATION

4. Compliance with Requirements of Local Cooperation. A formal assurance of local cooperation was furnished by the City of New London on 19 February 1970 which extended to both the Shaw Cove and Benthleys Creek segments of the project as authorized by Public Law 87-874. At that time, the State of Connecticut furnished the city a letter assuring that the State would provide half the cash contribution up to a limit of \$550,000 and would hold and save the Government free from damages due to the construction works.

By letter dated 20 April 1976 (Exhibit No. 17) the City of New London endorsed the revised project which deletes the Benthleys Creek segment and altered the Shaw Cove Dike portion. The State of Connecticut, Department of Environmental Protection, recently indicated that the amount which was authorized for the New London Hurricane Barrier several years ago will be made available upon request prior to commencement of construction.

In order to assure compliance with provisions under Section 210 and 305, Public Law 91-646 and Section 221, Public Law 91-611, updated agreements for local cooperation will be obtained from the State of Connecticut and the City of New London.

5. Concurrence of Plans. The plans have been discussed with city representatives and fully coordinated with the Executive Director of the New London Redevelopment Agency. The City has concurred in the plan and has requested that the Redevelopment Agency be consulted when final design commences in order to resolve some minor concerns which have been expressed by that Agency.

6. Estimated Cost of Local Cooperation. The estimated cost of local cooperation is as follows:

Lands, easements & rights of way	\$ 970,000
Relocations	45,000
Cash contribution, 30% of first cost less above	<u>1,385,000</u>
TOTAL	\$2,400,000

D. COORDINATION

7. General. The following Federal, State and local agencies were asked to furnish their views and letters received incorporating pertinent comments are included in Appendix A.

- U. S. Environmental Protection Agency
- U. S. Department of Commerce
- U. S. Department of Commerce Coastal Zone Management NOAA
- U. S. Department of Housing and Urban Development
- U. S. Department of Interior Bureau of Outdoor Recreation
- U. S. Department of Interior Fish and Wildlife Service
- U. S. Public Health Service Environmental Health Service
- U. S. National Park Service New England Region
- U. S. Coast Guard, 1st Coast Guard District
- U. S. Department of Transportation
- U. S. Federal Highway Administration
- U. S. Department of Agriculture
- New England Regional Commission
- New England River Basins Commission
- State of Connecticut Department of Environmental Protection
- State of Connecticut Commissioner of Health
- State of Connecticut Department of Agriculture
- State of Connecticut Commissioner of Transportation

8. Summary of Views. Comments received from the above agencies are favorable to the project plan and were given consideration in the preparation of this report. The U. S. Fish and Wildlife Service foresees no adverse effects on fish and wildlife as a result of the revised project.

State of Connecticut Department of Transportation stated that the project will not adversely affect the existing facilities or any projects planned in the New London area.

The City of New London endorsed the revised project and found it compatible with the urban redevelopment area.

E. PROJECT LOCATION

9. Location. The project is located in New London County, State of Connecticut, on the west side of the Thames River estuary approximately 45 miles southeast of Hartford, Connecticut, and 50 miles southwest of Providence, Rhode Island. The project will start at the intersection of Shaw and Hamilton Streets along the west side of the cove and terminate at high ground at Bank Street approximately 300 feet north of Spay Yard Street. Plate 2-2 shows the location of the project area.

F. HYDROLOGY AND TIDAL HYDRAULICS

10. Climatology.

a. General. The New London area has a temperature and changeable climate marked by four distinct seasons which are characteristic of its latitude and of the New England region. Owing to the moderating influence of Long Island Sound and the Atlantic Ocean, and particularly to the variable movements of high and low pressure systems approaching from the west or southwest, extremes of either hot or cold weather are rarely of long duration. In the winter, coastal storms frequently bring rainfall, in contrast to snow in the more northerly areas of Connecticut. In the summer, cooling relief is provided by sea breezes from the south, thunderstorms from the west, and cool air from the north. The prevailing winds are northwesterly in the winter and southwesterly in the summer. High winds, heavy rainfall, and abnormally high tides

occur with unpredictable frequency. Hurricanes can be expected, especially during August, September and October.

b. Temperature. The average annual temperature in the New London area is about 49° Fahrenheit, based on 18 years of record at Westbrook, Connecticut. January, the coldest month, has a mean temperature of 28.7° F, and July, the warmest month, has a mean temperature of 70° F. The lowest temperature recorded was -21° F in January, and the highest was 100° F in August. Monthly and annual temperature data are given in table 1.

c. Precipitation. The average annual precipitation in the New London area is about 47 inches, based on 19 years of record at Groton, Connecticut. It has ranged from a minimum of 34.5 inches to a maximum of 63.2 inches. The precipitation is fairly evenly distributed throughout the year. Average monthly rainfall varies between 2.5 inches in June and 5.0 inches in November. Extremes of monthly precipitation were 0.03 inches in June and 12.6 inches in August. Snowfall occurs from November to April, and averages about 25 inches per year. Monthly and annual precipitation data are given in table 2.

d. Hurricane rainfall. Hurricanes are generally accompanied by heavy rainfall, as shown on table 3, which lists rainfalls associated with recent hurricanes. The heaviest one-day rainfall experienced was 7.4 inches at Groton, Connecticut, in the September 1961 hurricane, "Esther".

e. Rainfall frequency. All-season rainfall frequencies were obtained from National Weather Service Technical Paper No. 40, "Rainfall Frequency Atlas of the United States". The maximum rainfall amount for various durations and frequencies are given in table 4.

TABLE 1

MONTHLY TEMPERATURE
WESTBROOK, CONNECTICUT
 (18 years)

Degrees Fahrenheit

<u>Month</u>	<u>Mean Daily</u>			<u>Range</u>	<u>Highest</u>	<u>Lowest</u>
	<u>Mean</u>	<u>Maximum</u>	<u>Minimum</u>			
January	28.7	38.7	18.6	20.1	60	-21
February	30.2	40.9	19.4	21.5	62	-14
March	36.3	47.4	25.2	22.2	85	-10
April	46.8	59.1	34.5	24.6	89	7
May	56.0	68.6	43.3	25.3	91	23
June	64.6	76.8	52.4	24.4	95	31
July	70.1	81.9	58.6	23.3	95	36
August	68.5	80.4	56.6	23.8	100	33
September	62.2	74.5	50.0	24.5	95	23
October	52.7	65.4	40.0	25.4	88	13
November	42.5	54.2	30.8	23.4	76	8
December	31.0	42.0	20.1	21.9	66	-17
ANNUAL	49.1	60.8	37.5	23.3	100	-21

TABLE 2
MONTHLY PRECIPITATION AND SNOWFALL
IN INCHES
GROTON, CONNECTICUT

<u>Month</u>	<u>Precipitation</u> (19 years)			<u>Snowfall</u> (10 years)
	<u>Mean</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Mean</u>
January	1.68	9.68	1.07	4.6
February	3.81	6.73	2.11	5.1
March	4.63	9.63	1.72	7.6
April	3.85	7.83	0.80	0.6
May	3.68	8.20	0.78	0.0
June	2.53	6.76	0.03	0.0
July	3.44	6.82	0.82	0.0
August	4.55	12.63	0.73	0.0
September	3.13	8.69	0.14	0.0
October	3.45	8.52	0.66	0.0
November	4.95	9.12	1.01	0.7
December	4.57	8.76	0.81	6.7
ANNUAL	47.27	63.21	34.49	25.3

TABLE 3

HURRICANE AND OTHER STORM RAINFALLVICINITY OF NEW LONDON, CONNECTICUT

(Accumulated Rainfall in Inches)

Hurricane or Other Storm	<u>Westbrook, Conn.</u>		<u>New London, Conn.</u>		<u>Groton, Conn.</u>		<u>Kingstown, R.I.</u>		<u>New Haven, Conn.</u>	
	Maximum 24-Hour	* Total	Maximum 24-Hour	* Total	Maximum 24-Hour	* Total	Maximum 24-Hour	Total	Maximum 24-Hour	Total
Sep 1938	-	-	-	-	-	-	1.3	1.3	6.4	11.
Sep 1944	2.8	6.2	3.4	7.1	-	-	2.4	4.4	4.0	8.5
Aug 31, 1954	4.4	4.4	4.5	5.0	3.4	3.5	2.9*	2.9	2.75	2.75
Sep 1954 (Edna)	5.6	5.6	4.0	5.3	6.2	6.2	5.5*	5.5	5.55	5.55
Aug 1955 (Connie)	4.3	7.3	2.0	4.0	5.1	5.6	5.3*	5.7	3.2	3.6
Aug 1955 (Diane)	1.4	2.2	1.8	1.8	1.2	2.3	2.2*	3.2	3.2	4.3
Oct 1955	-	5.1	-	-	2.3	4.3	3.1*	4.65	3.8	5.9
Sep 1960 (Donna)	3.8	4.3	-	-	3.2	3.8	1.6	1.7	5.3	5.5
Sep 1961 (Esther)	2.9	3.0	-	-	7.4	7.6	6.5	7.1	2.0	2.0

*Non-recording gage - values based on daily readings.

TABLE 4
RAINFALL FREQUENCY
NEW LONDON, CONNECTICUT
MAXIMUM RAINFALL DEPTH IN INCHES

<u>Duration</u>	<u>Frequency, Exceedence Interval in Years*</u>					
	<u>2</u>	<u>5</u>	<u>10</u>	<u>25</u>	<u>50</u>	<u>100</u>
30 Minutes	1.1	1.4	1.6	1.8	2.1	2.3
1 Hour	1.3	1.7	2.1	2.3	2.7	3.0
2 Hours	1.6	2.2	2.5	3.0	3.3	3.6
3 Hours	1.9	2.5	2.8	3.3	3.6	4.1
6 Hours	2.3	3.0	3.5	4.1	4.2	5.1
12 Hours	2.8	3.6	4.1	5.0	5.2	6.1

*Partial duration series

11. Hurricane Tidal Hydraulics

a. General. The change from the stillwater level produced by the Standard Project Hurricane to the 100-year frequency stillwater level as the basis for the design level of protection for the barrier necessitated re-analysis of certain pertinent tidal hydraulic conditions. The results of these analyses are presented in the following paragraphs. For additional tidal hydraulic information refer to Design Memorandum No. 1, "Hurricane Tidal Hydraulics", October 1965.

b. Design stillwater level. The 100-year stillwater level at the New London Hurricane Barrier is 10.5 feet above mean sea level datum (msl) and is equivalent to a surge of 8.6 feet concurrent with a mean spring high water of 1.9 feet msl. A tidal stage-frequency curve for New London is given on plate 1-6 of the above referenced Design Memorandum.

c. Maximum wave heights. The maximum height of waves in New London Harbor that can reach the barrier on the landside of the railroad tracks and east of Spar Yard Street (see plate 2-4) is limited by the depth of water over the tracks. A stillwater elevation of 10.5 feet msl produces an average depth of 2.5 feet over the railroad tracks. The maximum wave that can be sustained at this depth is 2.0 feet. The maximum runup as determined from figure 7-14 of the Shore Protection Manual, Volume II, 1973, is approximately 3.9 feet on a vertical wall.

Only waves that will be generated within the Cove itself can reach the barrier located along the inner shore of Shaw Cove because the railroad embankment (with top at approximately elevation 10 feet msl at the navigation channel) will effectively prevent waves in the harbor from entering the cove. With a fetch length of 1,000 feet in the north-south direction, the maximum generated wave height is 2.4 feet and the maximum runup on a 1 on 2 slope as determined from figure 7-19 of the Shore Protection Manual is approximately 4 feet. The height of the waves above the stillwater elevation of 10.5 feet msl is 1.2 feet or at elevation 11.7 feet msl.

d. Overtopping. In order to prevent overtopping by the action of waves emanating from New London Harbor the top of the wall and dike lying east of the pumping station will have an elevation of 14.5 feet msl. The top of the dike between stations 0+00 and 18+25 will be set at elevation 12.0 feet msl to protect against the waves that are generated within Shaw Cove in the north-south direction.

12. Interior Drainage.

a. General. The system of dikes and walls will intercept runoff from approximately 755 acres of interior area. The Shaw Cove watershed has been divided into three areas for the design of drainage facilities. Delineation of these interior drainage areas and facilities to be provided are shown on plate 2-9. The watershed is generally urban developed with the land use being 25 percent commercial and industrial, 60 percent residential and 15 percent cemeteries and parks.

b. Drainage area. Of the 755 acres of interior drainage area, 540 are categorized as "high level" and 215 are "low level". The high level area is further divided into a 250-acre sub-area that will be gravity drained by a pressure conduit during periods of low tides and a 290-acre sub-area from which runoff will be diverted to another watershed. The low level area will be drained by gravity during normal tide conditions but will have to be drained by pumping during abnormally high tides. The following paragraphs describe these interior subwatersheds and present the hydrologic criteria and analysis used in developing the interior drainage requirements.

(1) High level area. The lands outlined as "high level" on plate 2-9 have a total area of 540 acres. The drainage area begins at the point where Truman Brook crosses Grand Street and extends northwesterly to the Connecticut Turnpike and Two-mile Hill. Elevations vary from 20 to 210 feet msl.

The Connecticut Department of Transportation is presently constructing a storm drain system in Colman Street which will divert the runoff from 290 acres of the high level watershed out of the basin via the drainage system of Interstate Route 95.

The proposed pressure conduit will intercept Truman Brook at Grand Street and discharge runoff from the remaining 250 acres of the total high level area. The conduit will carry runoff down Jefferson Street to Bank Street and discharge into Shaw Cove adjacent to the proposed pumping station.

(2) Low level area. The low level area, shown on plate 2-9, totals 215 acres and is comprised of the remainder of the Truman Brook watershed, the urban renewal project area (45 acres) and a low area at the eastern end of the dike.

c. Design criteria.

(1) Pressure conduit. This conduit was sized to meet the more severe of the following two conditions:

(a) Convey the 100-year runoff with a coincident 10-year tide level of 6.5 feet msl.

(b) Convey the 10-year runoff with a coincident 100-year tide level of 10.5 feet msl.

Condition "a" governed the selection of the conduit diameter. Sizes of storm drains are discussed further in paragraph 13, Utility Modifications. Design discharges are presented in subsection d of this paragraph.

(2) Interceptor drains. Interceptor drains near the line of protection will intercept existing drains that would normally discharge runoff into Shaw Cove. They will be designed to carry a 10-year storm peak discharge rate with the drain running full and discharging by gravity. Design and construction of these drains will be performed by the City of New London as part of its Urban Renewal Project. The Colman Street interceptor under construction by the State of Connecticut has capacity to divert the 100-year storm runoff from the 290-acre high level area.

(3) Gravity outlet. The 78" x 78" pumping station gravity outlet will be designed to discharge a 100-year storm runoff with a mean high tide elevation of 1.63 feet msl.

d. Design discharges. Computed discharges from interior areas for storm rainfalls of various frequency are listed in tables 5 and 6. The rational formula was used to compute peak discharge rates for the sizing of drains using rainfall data presented on table 4.

e. Pumping station.

(1) General. A 210 cfs pumping station is required to drain runoff from the low lying areas adjacent to the urban renewal project during storm tides. The selected 210 cfs pumping station is considered an integral and inseparable part of the New London Hurricane Barrier. Under the current plan for elevating the urban renewal area, as opposed to the former plan of diking, drainage will be directed to the peripheral low lying areas and increased ponding levels will result during storm tides if a pumping station is not provided.

(2) Ponding areas. Due to high land values in the Shaw Cove area, land will not be acquired specifically for ponding interior runoff. Ponding stage "a" was determined to be elevation 6.0 feet msl. At this level very minor ponding will occur in the streets outside the urban renewal area and damages will be minor.

The entire low level area has been intensely developed for commercial, industrial and residential use with little, if any, open space remaining. Any temporary ponding above elevation 6.0 feet msl will cause significant damage. The storage capacity versus elevation relationship for the low level peripheral area, as determined from photogrammetric topography maps, is shown on plate 2-10.

(3) Coincident interior runoff. Criteria contained in design chart D-2 in EM 1110-2-1110 is not considered entirely applicable to the New London Project because it is based on the assumption that the interior runoff and tidal flooding result from independent events. It is highly probable that moderate interior runoff will be occurring at the time of abnormally high tide, both resulting from the same storm system.

Analysis of past floods indicates that the hurricanes are accompanied by moderate continuous rainfall. Hourly rainfall

TABLE 5

INTERIOR DRAINAGE DESIGN DISCHARGES
AND RATIONAL FORMULA DATA
FOR HIGH LEVEL AREA

<u>Frequency</u> (years)	<u>"C"</u>	<u>Total Area = 540 Acres</u> <u>tc = 60 minutes</u>		<u>Colman Street Diversion</u> <u>DA = 290 Acres</u> <u>tc = 30 minutes</u>		<u>Remaining Area after</u> <u>Diversion = 250 Ac.</u> <u>tc = 45 minutes</u>	
		<u>I (in/hr)</u>	<u>Q (cfs)</u>	<u>I (in/hr)</u>	<u>Q (cfs)</u>	<u>I (in/hr)</u>	<u>Q (cfs)</u>
5	0.35	1.70	320	2.8	280	2.1	185
10	0.45	2.10	510	3.2	420	2.5	280
25	0.45	2.30	560	3.6	470	2.9	325
50	0.45	2.65	645	4.2	550	3.2	360
100	0.50	3.00	810	4.6	660	3.7	460

TABLE 6

INTERIOR DRAINAGE DICHARGES
FOR LOW LEVEL AREA

<u>Frequency</u> (years)	<u>I</u> (in/hr)	<u>"C"</u>	<u>Q</u> (cfs)
2	2.1	0.35	160
5	2.8	0.35	210
10	3.2	0.35	240
25	3.6	0.45	350
50	4.1	0.45	400
100	4.6	0.50	495

Drainage Area = 215 Acres

Time of Concentration = 30 minutes

data are not available for New London, but at a nearby weather recording station at Jewett City such data has been measured since 1940. Historic tide events at New London and associated rainfall rates measured at Jewett City are listed in table 7.

TABLE 7

HISTORICAL STORM TIDES AND ASSOCIATED
RAINFALL INTENSITIES

<u>Storm Event</u>	<u>Tide Elev.</u> (ft msl datum)	<u>Recurrence</u> <u>Interval</u> (years)	<u>Max. Rainfall</u> <u>Rate</u> (in. /hr.)
Hurr. Sep 1938	9.7	1.6	0.63*
Hurr. Aug 1954	8.9	2.5	1.15
Storm Nov 1950	6.7	8.5	0.39
Hurr. Sep 1944	6.2	12.0	1.03
Hurr. Sep 1960	6.0	14.0	0.78.

*Measured at New Haven, Conn.

(4) Design capacity. The selected design capacity of 210 cfs provides a pumping station capable of discharging runoff at the rate of about 1 inch per hour from the contributing area, which approximates the rainfall rates associated with the known historical storm tide events presented in table 7.

With no pumping station in the project it is highly probable that ponding levels in the peripheral area during coincident rainfall and storm tides would be higher than under pre-project conditions. This is demonstrated by the curves on plate 2-11 which present the relative stage-frequency relationships for the pre-project conditions and for post-project conditions with various pumping capacities.

Present average annual tidal damages in the peripheral low lying areas resulting from storm tides up to the 100-year level have been estimated at about \$50,000. Obviously this value will increase in the future with improvements that will take place as a result of completion of the nearby urban renewal project. As

demonstrated by the stage-frequency curves shown on plate 2-11, these annual damages will be practically eliminated and realized as a benefit with the selected pumping capacity.

The effectiveness of the selected 210 cfs pumping station is demonstrated on plate 2-12. The condition selected for analysis consisted of runoff from the 10-year rainfall coincident with a 100-year tide. As shown on plate 2-12 a ponding elevation of 6.3 feet msl results from this condition and damages are a minimum. In contrast, the omission of a pumping station would cause a ponding elevation of 10.9 feet msl and 1.2 million dollars of damage outside the urban renewal area and additional damages in the urban renewal area.

13. Utility Modifications.

a. Sanitary sewer, water and gas. The existing 18-inch diameter gravity sewer which crosses the line of protection near Hamilton Street and Shaw Street will have an emergency gate provided to permit closure in the event of pipe failure which would allow the entrance of tidal water through the pipe into the protected area. Should it be necessary to make this emergency closure of the sewer line, any sewage being discharge through the pipe would pond in the area behind the protection, where the pipe failure had occurred, until repairs were made to the pipe or until the tide had receded and the emergency gate could be opened.

The existing 27-inch diameter gravity sewer which crosses the line of protection near Hamilton Street and Howard Street will have an emergency gate provided as indicated above for the 18-inch sanitary sewer. Existing manholes on the above sewer lines will be raised as required by the fill being placed in the area.

Existing utility lines will be relocated or modified, as necessary, for the installation of the 96-inch diameter pressure conduit. In addition, any utility lines which cross under the protection will be provided with emergency closures. Relocation of existing utility lines in Howard Street will be accomplished as part of the Urban Redevelopment Project.

b. Storm drains. Existing drainage in the area consists of a series of box culverts extending from Garibaldi Square to an outlet into the south end of Shaw Cove at the Howard Street Bridge. In addition, there are 3 drains (24" diameter, 18" diameter, and 42" diameter) which discharge into the north end of Shaw Cove south of Bank Street as shown on Plate 2-22.

The area to the west of Shaw Cove will be graded to permit collection of interior runoff in the new 72" diameter storm drain in Bank Street as shown on Plate 2-1. The future relocation of Howard Street by Urban Redevelopment, will provide grading and drainage as shown on Plates 2-20 and 2-22. Drainage thus collected will be conveyed to the new pump station where it will discharge by gravity or be pumped as required.

Storm runoff from the northwest will be collected by a 96" diameter pressure conduit and a 72" diameter gravity drain. These pipes will replace the existing box culverts from Garibaldi Square to Shaw Cove (near Hamilton Street and Howard Street).

Storm runoff from the east of Shaw Cove, between Bank Street and the line of protection, will be collected in a new drain located on the land side of the protection as shown on Plate 2-4. Discharge will be through the pump station by gravity or pumping as required via connection to the 72" gravity drain. Drainage north of Bank Street will be collected in drains to be installed by the New London Redevelopment Agency in Bank Street as shown on Plate 2-22. Existing 24", 18" and 42" drains which presently discharge into Shaw Cove will be intercepted by this drain which will discharge through the pump station via the new 72" gravity drain.

All gravity drains are designed for a 10-year storm except the 78" x 78" gravity outlet at the pump station which is sized for a 100-year storm and will be provided with a sluice gate.

A small storm water ejector station is proposed as part of the Urban Renewal Project. It is located at the Billings P. Learned Mission and discharges to the proposed gravity drain in Shaw Street, as shown on Plate 2-22. This ejector station is required since the above mentioned property cannot be filled because it will not be acquired for urban renewal and will create a local low spot when the adjacent areas are filled (Plate 2-20).

G. GEOLOGY

14. Site Geology. New London, Connecticut, lies on the western flank of a narrow topographic funnel draining the Thames River Basin, an elliptically shaped area of 1,474 square miles most of which lies in Connecticut on the southern edge of the New England upland between the Connecticut River basin and the Narragansett Bay basin. The structural origin of the steep-walled Thames River estuary has been variously ascribed to fjord-like glacial erosion of a preglacial stream valley or simply to drowning of the river valley. The hills bordering the estuary attain elevations of about 300 feet, with frequent bedrock exposures, mostly Lower Paleozoic granitic gneiss which occurs throughout much of the area and extends into western Rhode Island. Overburden on the hills is mostly sandy till, with intervening small marshy areas containing some outwash sand and gravel. Fringes of low-lying outwash deposits with marine deposits and artificial fills occur along the project alignment of the New London waterfront.

15. Subsurface Investigations. Ten explorations have been made at the location of the project structures. Additional subsurface data is available from selected borings made by others in connection with studies for the New London Redevelopment Agency in 1973 and 1974. For location of applicable borings see Plate 2-7 and 2-8 and for representative boring logs see Pages 24-33. Final design may require a limited number of additional explorations for critical structures.

16. Foundation Conditions. The project will be constructed on existing fills varying in thickness from 5 to over 15 feet. A typical geological profile (see Plate 2-8) shows that in some reaches these fills are underlain by organic silt varying in thickness from a few to over 20 feet. A thick deposit of organic silt is found in the area bounded by Shaw, Bank, Hamilton and Howard Streets which was once part of Shaw Cove before being filled. There is no exact record of the timing and type of filling that has taken place. The filling was generally uncontrolled and the type of fill encountered in this area is very heterogeneous. Fine sands and silts in turn underlie the organic silts and fills. A thin layer of compact gravelly sandy glacial till overlies the bedrock surface which is at a depth of 6 feet at the west end of the project and at depths greater than 55 feet at the east end.

17. Seismicity. The New London Area is placed in the category of minor damage (Zone 1) according to the seismic risk map recently developed by the Environmental Science Service Administration and the Coastal and Geodetic Survey. According to Engineering Regulation ER 1110-2-1806 dated April 1977, hydraulic structures in Zone 1 will be designed to withstand a seismic probability coefficient of 0.025.

18. Construction Materials.

a. Materials from Required Excavations. The materials from required excavations will consist primarily of artificial fills and minor amounts of organic silts. It is estimated that most of the man-made fills can be used as dumped waste fill to fill low areas behind the dikes and floodwalls.

b. Impervious Fill. More than 65,000 cubic yards of impervious fill will be required for the embankment and miscellaneous fills. Glacial till will be made available from city-owned land on reservoir property in nearby Montville, a truck haul distance of approximately 7 miles. The area has been previously explored with borings and the material is suitable.

c. Sand and Gravel. Approximately 7,500 c.y. of gravel will be needed for bedding and fill materials. Gravel of suitable quality and gradation are available from commercial sources located within 5 to 10 miles from the site. Approximately 10,000 c.y. of sand fill also is required. Suitable sand is available within 5 miles of the site.

d. Stone. Quarried rock materials of suitable quality are available from commercial suppliers located in Montville, East Lyme and Branford, Connecticut and Westerly, Rhode Island within a 12 to 45 mile radius from the project site.

e. Concrete Materials. A detailed discussion of concrete materials was submitted in Design Memorandum No. 3, Concrete Materials in November 1965, and updated in March 1970. A new updating revision will be performed for the Feature Design Memorandum with an anticipated submission date of January 1978. As of the last revision, there were four tested and approved sources which are listed in TM No. 6-370 and are as follows:

Boring No. PD-90 Desig. 2 Diam. (Casing) 1 1/2"

Co-ordinates: N 40° 10' 30" S E 110° 00' 00" W

FIELD LOG OF TEST BORING

Elevation Top of Boring +6.0 M.S.L. Hammer Wt. 350 LB. Boring Started 31 JULY 73
Total Overburden Drilled _____ Feet Hammer Drop 18"
Elevation Top of Rock _____ M.S.L. Casing Left None Boring Completed 8 AUG. 73
Total Rock Drilled _____ Feet Subsurface Water Data _____ Page _____
Elevation Bottom of Boring -12.8 M.S.L. Obs. Well _____
Total Depth of Boring 68.8 Feet Drilled By Corps of Engineers
Core Recovered 92 % No. Boxes 2 Mfg. Des. Drill CP-5
Core Recovered 19.0 Ft : 1 1/4" Diam. _____ In. Inspected By: Michael M. Fendley
Soil Samples 2 1/2" ID x 5" In. Diam. 3 No. Classification By: _____
Soil Samples 2" ID x 5" In. Diam. 17 No. Classification By: _____

DEPTH 1" = 2'	CORE/SAMPLE		BLOWS PER FT. CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	NO.	SIZE			
0.8	F1 (1)	2 1/2"	15	DEPOS DRY THE 2 1/2" ID x 5" SAND SAMPLE FROM 6.0 TO 5.0 BY IMPACT OF 350 LB. HAMMER FALLING 18" EACH BLOW.	TOP SOIL BROWN-SILT-GRAVELLY C.F. SAND (SM) Most of it (SP)
2.0	F2 (1)	0	27	PULLED SPOON AND TOOK SAMPLE 10% REMOVAL	NO CHANGE GRAY-BLACK-SILT- C.F. SAND (SM)
2.5	F3 (1)	5	39	WENT DOWN TO 5.0.	Most
4			16		
5.0			5	DEPOS 2" ID x 5" S.S. SPOON FROM 5.0 TO 10.0.	BLACK-SILT- OFF SAND
6			4	PULLED SPOON AND TOOK SAMPLE 15% REMOVAL	Most (SM) apoccs. gravel & oil
8	F4 (1)	x	2	TRIED W/TH CASING FROM 6.0 TO 10.0.	
		5	2		
10.0			1		

GENERAL REMARKS: Hole located in grassy empty lot adjacent to tank farm. For City Oil Co. storm sewers run to east of location. Area used for abandoned cars.

DEPTH		CORE/SAMPLE		BLOWS PER FT.	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
"-2"	NO.	SIZE	DEPTH RANGE	CORRECTION		
27.0	J-11	2"	27.0	9	DRILL SPIN AND TOOK SAMPLES	
28	(2)	D		15	100% RECOVERY	
	J-12	2"		16	SET UP AND CASING TO 30.0.	
30.0			30.0			
		2"	30.0	6	DRIVE 2" 50x5 S.S. SPIN FROM 30.0 TO 35.0.	<i>Blocky - fine</i>
		I		7	DRILL SPIN AND TOOK SAMPLES	<i>Most in place (5m)</i>
32	J-13	2"		14	100% RECOVERY	<i>4/5 sand seams & minimal stain.</i>
	(2)	D		20	SET UP AND CASING TO 35.0.	
	J-14	2"		20		
34	(1)	x				
		5		20		<i>similar to J-11</i>
35.0			35.0			
		2"	35.0	9	DRIVE 2" 50x5 S.S. SPIN FROM 35.0 TO 40.0.	
36	J-15	2"		12	DRILL SPIN AND TOOK SAMPLES.	
	(2)	D		11	100% RECOVERY	
	J-16	2"		36	SET UP AND CASING TO 40.0.	
38	(1)	x				
39.0	J-17	5	39.0	138		<i>Blocky - 50% (3m)</i>
40.0	(1)		40.0			<i>Sandy - silty</i>
		2"	40.0	44	DRIVE 2" 50x5 S.S. SPIN FROM 40.0 TO 41.6. AT 41.6 SLUG RECOVERED.	<i>GRAVEL (3m)</i>
	J-18	2"	41.6	180	DRILL SPIN AND TOOK SAMPLES. 100% RECOVERY.	<i>GRAVEL (6m)</i>
41.6	(1)	x	41.6		CASING SET UP TO 41.6. SET UP TO 41.6.	<i>Most w/ rock fragments fine</i>
42	Box	1	42.0		ROTARY DIAMOND DRILL BOULDER FROM 41.6 TO 44.6. RUN 5.0 RBC. 27 54% DANGER: RECLIN 1 HOUR.	<i>BOULDER 0.7 to Pieces</i>
44.6			44.6			

Site: *1000 ft. deep*
1000 ft. deep

Boring No. *FD-70*

Page *1*
of *1*

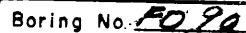
DEPTH	CORE/SAMPLE		BLOWS PER FT. CORE RECVY	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
	NO.	SIZE			
41.0		N 3/8	41.5	CORED 4 1/2" X 5 1/2" BIT DT. CORE BARREL (118670)	
46	Box 1	1 1/2	46.0	HYD. FLOO - MEDIUM RAID OF RUN 3" OF CHASE IN HOLE COR'D 4 1/2" X 5 1/2" CASING	
46.6		2 1/2	46.7	250	
48.2	T-19 (2)	0 1/2	48.2	185	
48.2	Box 1	N 1/2	48.2	DRIVE 2" LONG 5.5 SPOON FROM 46.6 TO 48.2 AT 48.2 SOLID REFUSAL COR'D 4 1/2" X 5 1/2" CASING TO 48.2	GRAY-BROWN- WEATHERED ROCK. w/stratification
48.9	Box 1	N 1/2	48.9	CORED BEDROCK FROM 48.2 TO 48.9. RAN 0.7 REC. 0.5 71% ANN BIT 9 PG. BLOCKED	TOP OF SOLID ROCK & W/STRATIFICATION
49.2	Box 1	N 1/2	49.2	CORED ROCK FROM 48.9 TO 49.2	0.3 to 100%
50.1	Box 1	N 3/8	50.1	CORED BEDROCK FROM 49.2 TO 50.1 BIT BLOCKED BIT. 4 1/2" X 5 1/2" 118670	1 piece 0.3 to clay sand.
51.3	None	N 3/8	51.3	CORED BEDROCK FROM 50.1 TO 51.3. RAN 1.2 REC. 0.0 BIT BLOCKED 4 1/2" X 5 1/2" 118673	no recovery
52.2	T-20 (2)	2 1/2	52.2	80	
52.2	Box 1	N 3/8	52.2	100	
55.0		N 3/8	55.0	CORED BEDROCK FROM 52.2 TO 55.0. BIT BLOCKED RAN 1.8 REC. 2.7 96% 46 MINUTES 3" OF CHASE IN HOLE COR'D 4 1/2" X 5 1/2" CASING TO 55.0	GRAY BEDROCK. TOP OF ROCK GNEISS light gray to pink with black amphibolite zones and scattered magnetite. Fresh, hard and sound.
56.8	Box 1	N 3/8	56.8	CORED BEDROCK FROM 55.0 TO 56.8. BIT BLOCKED 30 MINS RAN 1.8 REC. 1.0 110%	
56.8	Box 2	N 3/8	56.8	PRIMARY DIAMOND DRILL BEDROCK FROM 56.8 TO 61.0 RAN 5.0 REC. 5.0 100% TIME 40 MINUTES WASH. MILKY WHITE & MOLDING HYD. FLOO - MEDIUM 118670 BIT 118667	Vertical unweathered joint, 54.0 to 55.0 and 60.0 to 61.0.

DEPTH		CORE/SAMPLE		BLOWS PER FT.	SAMPLING AND CORING OPERATIONS	CLASSIFICATION OF MATERIALS
F. 2'	NO.	SIZE	DEPTH RANGE	CORE RECVY		
61.0	Box 2	4x 3/2	61.07	11		
62		11	61.87	11	ROTARY DIAMOND DRILL BEDROCK FROM 61.8 TO 61.8 END OF RUN. RAW 5.0 REC. 5.0 100% TIME 41 MINUTES WASH: MILKY WHITE HOLDING. HYD FEED MEDIUM NIX BIT 11P667	
64	Box 2	11		11		
66		6		11		
66.8	Box 2	11	66.87	11	ROTARY DIAMOND DRILL BEDROCK FROM 66.8 TO 66.8. END OF RUN RAW 2.0 REC. 1.9 95% TIME 20 MINUTES WASH: MILKY BEAN HOLDING. HYD FEED MEDIUM NIX BIT 11P667	
68.8						

Bottom of Exploration @ 68.8
Depth Considered Surrounded

Page 6 of 6

Note: Depths are in feet below original ground



CLARENCE WELTI ASSOC., INC.
100 SYCAMORE STREET
GLASTONBURY, CONN. 06033

1226-95-01

"BORING LOG"

CHANDLER COVE
NEW LONDON, CONN.
PROJ. _____
CLIENT NEW LONDON REDEVELOPMENT

BORING NO. S-15
LINE & STA. _____
OFFSET _____
GR. ELEV. _____

BORING NO. S-16
LINE & STA. _____
OFFSET _____
GR. ELEV. _____

A	STRATUM DESCRIPTION	BLOWS PER 6"	B
	BR. FINE-CRS. SAND & SILT, ASHES, CINDERS & WOOD, OTHER MISC. FILL		
		12-7-5	
	WET @ 10'		
		8-14-21	
		7-22-16	
22.0		27-32-23	
	GR/BR. FINE SAND, SOME SILT (SATURATED)		
		25-27-26	
		25-26-26	
33.0			
	ROCK RUN #1 33-38' REC. 25" (SEAMY)		
38.0			
	BOTTOM OF BORING 38.0		
	WATER AT 8.0 AT 0 HRS.		
	WATER AT 7.0 AFTER 24 HRS.		
	DATE: 7/13/70		
	DRILLER: PAGE		

A	STRATUM DESCRIPTION	BLOWS PER 6"	B
0.3	CONCRETE		
	BR. FINE-CRS. SAND, ROCK FRAG. & MISC. FILL		
		18-18-41	
8.0			
	GR/BR. FINE SAND, SOME SILT W/ ROCK FRAGMENTS		
		6-8-12	
16.0		27-75	
	REFUSAL AT 16.0		
	WATER AT 10.0		
	DATE: 7/13/70		
	DRILLER: PAGE		

1. COL. A STRATA DEPTH
2. COL. B
3. HAMMER = 140#; FALL 30"
4. SAMPLER = _____ O.D. SPLIT SPOON
5. GWT = GROUND WATER

30

AND - 40 to 50%
SOME - 10 to 40%
TRACE - 0 to 10%

American Drilling & Boring Co., Inc.

100 WATER STREET EAST PROVIDENCE, R. I.

TO New London Redevelopment Agency

PROJECT NAME Show's Cove Urban Renewal

REPORT SENT TO

SAMPLES SENT TO

ADDRESS New London, Ct.

LOCATION New London, Ct.

PROJ. NO. Corin. R-126

OUR JOB NO. 4-159

SHEET 1 of 1

DATE

HOLE NO. LSC-25

LINE & STA.

OFFSET

SURF. ELEV.

GROUND WATER OBSERVATIONS				Rods-AW	CASING	SAMPLER	CORE BAR	Date	Time
At 5'-6"	after 1/4	Hours		Type	BW	S/S		START	11/13/73
casing @ 20'				Size I.D.	2-1/2"	1-3/8"		COMPLETE	11/14/73
At 5'-6"	after 1/2	Hours		Hammer Wt.	300#	140#		TOTAL HRS.	
hole open				Hammer Fall	24"	30"	BIT	BORING FOREMAN	A.D'Atello
								INSPECTOR	
								SOILS ENGR.	

LOCATION OF BORING:

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler			Moisture Density or Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE		
				From 0-6	To 6-12	To 12-18				No	Pen	Rec.
		1' - 2'-6"	D	3	4	6	moist loose		Black, coal, cinders, sand, ashes, FILL	1	18"	12"
							wet loose					
		5' - 6'-6"	D	2	1	1	wet loose	7'-0"		2	18"	3"
								9'-0"	Gray ORGANIC SILT			
		10' - 11'-6"	D	7	8	9	wet medium dense		Brown fine SAND, little silt	3	18"	7"
		15' - 16'-6"	D	5	7	8	"			4	18"	12"
		20' - 21'-6"	D	7	7	8	"			5	18"	11"
		25' - 26'-3"	D	3	9	8	"			6	16"	12"
								30'-0"				
		30' - 31'-5"	D	6	8	7	wet stiff		Brown SILT & fine sand layers	7	18"	7"
		35' - 35'-5"	D	5	8	11	wet very stiff			8	18"	12"
							wet hard					

GROUND SURFACE TO

USED BW CASING

Sample Type

D=Dry C=Cored W=Washed

UP=Undisturbed Piston

TP=Test Pit A=Auger V=Vane Test

UT=Undisturbed Thinwall

Proportions Used

trace 0 to 10%

little 10 to 20%

some 20 to 35%

and 35 to 50%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density

0-10 Loose

10-30 Med. Dense

30-50 Dense

Cohesive Consistency

0-4 Soft

4-8 M/Stiff

8-15 Stiff

30+ Hard

SOILS

Earth Boring

Rock Boring

Samples

HOLE NO.

American Drilling & Boring Co., Inc.

100 WATER STREET EAST PROVIDENCE, R. I.

TO New London Redevelopment Agency ADDRESS New London, Ct.
PROJECT NAME Shaw's Cove Urban Renewal LOCATION New London, Ct.
REPORT SENT TO _____ PROJ. NO. Conn. R-125
SAMPLES SENT TO _____ OUR JOB NO. 4-159

SHEET _____ OF 2
DATE _____
HOLE NO. LSC-20
LINE & STA. _____
OFFSET _____
SURF. ELEV. _____

GROUND WATER OBSERVATIONS		Rods-AW	CASING	SAMPLER	CORE BAR	START	Date	Time
At <u>5'6"</u>	after _____ Hours	Type	HW &	S/S	AXD-3	COMPLETE	<u>11/1/73</u>	_____ a.m.
<u>5' H-S / A</u>		Size I.D.	BW	<u>1-3/8"</u>	<u>1-1/8"</u>	TOTAL HRS.	<u>11/2/73</u>	_____ p.m.
At <u>11'-6"</u>	after <u>0</u> Hours	Hammer Wt.		<u>140#</u>	BIT	BORING FOREMAN	<u>Holley</u>	
		Hammer Fall		<u>30"</u>	Diamond	INSPECTOR	<u>Sweet</u>	
						SOILS ENGR.		

LOCATION OF BORING:

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler			Moisture Density or Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE		
				From 0-6	6-12	To 12-18				No.	Pen	Rec.
		<u>1'-2'-6"</u>	<u>D</u>	<u>10</u>	<u>18</u>	<u>18</u>	<u>moist dense</u>		<u>Black fine to medium sand, cinders, little coarse to fine gravel, trace silt, trace organic matter, FILL</u>	<u>1</u>	<u>13"</u>	<u>12"</u>
		<u>5'-6'-6"</u>	<u>D</u>	<u>5</u>	<u>4</u>	<u>4</u>	<u>wet loose</u>			<u>2</u>	<u>18"</u>	<u>12"</u>
		<u>10'-11'-6"</u>	<u>D</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>"</u>	<u>11'-0"</u>		<u>3</u>	<u>18"</u>	<u>12"</u>
		<u>13'-6"-15'</u>	<u>D</u>	<u>PRESSED</u>			<u>wet soft</u>	<u>12'-6"</u>	<u>Black-brown ORGANIC SILT, cinders, & fine sand mixed</u>	<u>4</u>	<u>18"</u>	<u>8"</u>
		<u>15'-6"-17'-6"</u>	<u>UP</u>	<u>PRESSED</u>			<u>"</u>		<u>Brown-gray ORGANIC SILT</u>	<u>up1</u>	<u>24"</u>	<u>24"</u>
		<u>18'-19'-6"</u>	<u>D</u>	<u>PRESSED</u>			<u>"</u>			<u>--</u>	<u>18"</u>	<u>0"</u>
		<u>20'-21'-6"</u>	<u>D</u>	<u>PRESSED</u>			<u>wet medium dense</u>	<u>23'-6"</u>		<u>5</u>	<u>18"</u>	<u>18"</u>
		<u>22'-24'</u>	<u>UP</u>	<u>PRESSED</u>			<u>"</u>			<u>up2</u>	<u>24"</u>	<u>24"</u>
		<u>24'-6"-26'</u>	<u>D</u>	<u>9</u>	<u>8</u>	<u>9</u>	<u>wet medium dense</u>	<u>28'-0"</u>	<u>Brown-gray fine to medium SAND, coarse to fine gravel, Little organic silt, trace coarse sand</u>	<u>6</u>	<u>18"</u>	<u>16"</u>
		<u>30'-31'-6"</u>	<u>D</u>	<u>24</u>	<u>36</u>	<u>48</u>	<u>wet very dense</u>		<u>Brown -gray fine to medium SAND, some coarse to fine gravel, little silt, broken Gneiss fragments</u>	<u>7</u>	<u>18"</u>	<u>8"</u>
		<u>35'-36'-6"</u>	<u>D</u>	<u>29</u>	<u>32</u>	<u>48</u>	<u>"</u>	<u>39'-0"</u>		<u>8</u>	<u>18"</u>	<u>12"</u>
								<u>40'-0"</u>	<u>Broken GNEISS</u>			

GROUND SURFACE TO 24'

USED HW-3-1/2 CASING: THEN BY 2-1/2" TO 40', THEN C TO 45'

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%
and 35 to 50%

140lb Wt. x 30" fall on 2" O.D. Sampler
Cohesionless Density Cohesive Consistency
0-10 Loose 0-4 Soft 30+ Hard
10-30 Med. Dense 4-8 M/Stiff
30-50 Dense 8-15 Stiff
50+ Very Dense 15-30 V-Stiff

SUMMARY:
Earth Boring 40'
Rock Coring 5'
Samples 8

HOLE NOLSC-20

American Drilling & Boring Co., Inc.

EAST PROVIDENCE, R. I.

ADDRESS same as 1

LOCATION

PROJ. NO.

OUR JOB NO

DATE _____

HOLE NO LSC-20

LINE & STA.

LINE & STA. _____
 050057

OFFSET _____

SHORE ELEV _____

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR	Core	Time
At _____	after _____ Hours	Type _____	_____	_____	START _____	a.m.
		Size I.D. _____	_____	_____	COMPLETE _____	p.m.
		_____ same as _____	_____	_____	TOTAL HRS. _____	p.m.
At _____	after _____ Hours	Hammer Wt. _____	_____	BIT _____	BORING FOREMAN _____	
		Hammer Fall _____	_____	_____	INSPECTOR _____	
			_____	_____	SOILS ENGR. _____	

LOCATION OF BORING:

[illegible]

USED

CASING: THEN

Proportions Used

trace 0 to 10%

little 10 to 20%

some 20 to 35%

Cohesive Consistency

0-4 Soft 30 + Hard

4-8 M/Stiff

8-15 Shift
15 30 45 60 75 90 105 120 135 150 165 180 195 210 225 240 255 270 285 300 315 330 345 360 375 390 405 420 435 450 465 480 495 510 525 540 555 570 585 600 615 630 645 660 675 690 705 720 735 750 765 780 795 810 825 840 855 870 885 900 915 930 945 960 975 990 1005 1020 1035 1050 1065 1080 1095 1110 1125 1140 1155 1170 1185 1200 1215 1230 1245 1260 1275 1290 1305 1320 1335 1350 1365 1380 1395 1410 1425 1440 1455 1470 1485 1500 1515 1530 1545 1560 1575 1590 1605 1620 1635 1650 1665 1680 1695 1710 1725 1740 1755 1770 1785 1800 1815 1830 1845 1860 1875 1890 1905 1920 1935 1950 1965 1980 1995 2010 2025 2040 2055 2070 2085 2100 2115 2130 2145 2160 2175 2190 2205 2220 2235 2250 2265 2280 2295 2310 2325 2340 2355 2370 2385 2400 2415 2430 2445 2460 2475 2490 2505 2520 2535 2550 2565 2580 2595 2610 2625 2640 2655 2670 2685 2700 2715 2730 2745 2760 2775 2790 2805 2820 2835 2850 2865 2880 2895 2910 2925 2940 2955 2970 2985 3000 3015 3030 3045 3060 3075 3090 3105 3120 3135 3150 3165 3180 3195 3210 3225 3240 3255 3270 3285 3300 3315 3330 3345 3360 3375 3390 3405 3420 3435 3450 3465 3480 3495 3510 3525 3540 3555 3570 3585 3600 3615 3630 3645 3660 3675 3690 3705 3720 3735 3750 3765 3780 3795 3810 3825 3840 3855 3870 3885 3900 3915 3930 3945 3960 3975 3990 4005 4020 4035 4050 4065 4080 4095 4110 4125 4140 4155 4170 4185 4200 4215 4230 4245 4260 4275 4290 4305 4320 4335 4350 4365 4380 4395 4410 4425 4440 4455 4470 4485 4500 4515 4530 4545 4560 4575 4590 4605 4620 4635 4650 4665 4680 4695 4710 4725 4740 4755 4770 4785 4800 4815 4830 4845 4860 4875 4890 4905 4920 4935 4950 4965 4980 4995 5010 5025 5040 5055 5070 5085 5100 5115 5130 5145 5160 5175 5190 5205 5220 5235 5250 5265 5280 5295 5310 5325 5340 5355 5370 5385 5400 5415 5430 5445 5460 5475 5490 5505 5520 5535 5550 5565 5580 5595 5610 5625 5640 5655 5670 5685 5700 5715 5730 5745 5760 5775 5790 5805 5820 5835 5850 5865 5880 5895 5910 5925 5940 5955 5970 5985 6000 6015 6030 6045 6060 6075 6090 6105 6120 6135 6150 6165 6180 6195 6210 6225 6240 6255 6270 6285 6300 6315 6330 6345 6360 6375 6390 6405 6420 6435 6450 6465 6480 6495 6510 6525 6540 6555 6570 6585 6600 6615 6630 6645 6660 6675 6690 6705 6720 6735 6750 6765 6780 6795 6810 6825 6840 6855 6870 6885 6900 6915 6930 6945 6960 6975 6990 7005 7020 7035 7050 7065 7080 7095 7110 7125 7140 7155 7170 7185 7200 7215 7230 7245 7260 7275 7290 7305 7320 7335 7350 7365 7380 7395 7410 7425 7440 7455 7470 7485 7500 7515 7530 7545 7560 7575 7590 7605 7620 7635 7650 7665 7680 7695 7710 7725 7740 7755 7770 7785 7800 7815 7830 7845 7860 7875 7890 7905 7920 7935 7950 7965 7980 7995 8010 8025 8040 8055 8070 8085 8100 8115 8130 8145 8160 8175 8190 8205 8220 8235 8250 8265 8280 8295 8310 8325 8340 8355 8370 8385 8400 8415 8430 8445 8460 8475 8490 8505 8520 8535 8550 8565 8580 8595 8610 8625 8640 8655 8670 8685 8700 8715 8730 8745 8760 8775 8790 8805 8820 8835 8850 8865 8880 8895 8910 8925 8940 8955 8970 8985 9000 9015 9030 9045 9060 9075 9090 9105 9120 9135 9150 9165 9180 9195 9210 9225 9240 9255 9270 9285 9300 9315 9330 9345 9360 9375 9390 9405 9420 9435 9450 9465 9480 9495 9510 9525 9540 9555 9570 9585 9600 9615 9630 9645 9660 9675 9690 9705 9720 9735 9750 9765 9780 9795 9810 9825 9840 9855 9870 9885 9900 9915 9930 9945 9960 9975 9990 10005 10020 10035 10050 10065 10080 10095 10110 10125 10140 10155 10170 10185 10200 10215 10230 10245 10260 10275 10290 10305 10320 10335 10350 10365 10380 10395 10410 10425 10440 10455 10470 10485 10500 10515 10530 10545 10560 10575 10590 10605 10620 10635 10650 10665 10680 10695 10710 10725 10740 10755 10770 10785 10800 10815 10830 10845 10860 10875 10890 10905 10920 10935 10950 10965 10980 10995 11010 11025 11040 11055 11070 11085 11100 11115 11130 11145 11160 11175 11190 11205 11220 11235 11250 11265 11280 11295 11310 11325 11340 11355 11370 11385 11400 11415 11430 11445 11460 11475 11490 11505 11520 11535 11550 11565 11580 11595 11610 11625 11640 11655 11670 11685 11700 11715 11730 11745 11760 11775 11790 11805 11820 11835 11850 11865 11880 11895 11910 11925 11940 11955 11970 11985 12000 12015 12030 12045 12060 1

Earth Exting

Rock Coring

Samples _____

HOLF NO 1 SC-2

James Romanella and Sons, Incorporated
Gales Ferry, Connecticut
formerly Grotton Ready Mix Incorporated

Latitude 41° N - Longitude 72° W, Index No. 20 (Rev.)

John J. Doyle Sand and Gravel Company
Uncasville, Connecticut

Latitude 40° N - Longitude 72° W, Index No. 21

The Ryan Company, Incorporated
Fitchville, Connecticut
formerly in Salem, Connecticut

Latitude 41° N - Longitude 72° W, Index No. 22

New Haven Trap Rock Company
Wauregan, Connecticut
formerly Dunning Sand and Gravel Company

Latitude 41° N - Longitude 71° W, Index No. 1 (Suppl.)

H. OTHER PLANS INVESTIGATED

19. Original Protection Plan. The original protection plan for the City of New London was formulated in 1965 and presented in General Design Memorandum No. 2, dated 12 January 1966. The scope of the project was considerably greater in that the plan provided protection for both the Shaw Cove and Bentleys Creek segments of the city. The Shaw Cove segment consisted of a rock faced earth dike approximately 1,900 feet long, running across the mouth of Shaw Cove extending from the Atlantic Oil Company property (north of Smith Street) on the south and terminating on the north at Bank Street. Within the dike a 45-foot navigation opening was provided to permit boats to pass through the barrier.

Prior to advertising, the city requested a deferment on construction due to strong public sentiment against local expenditures for the project. The New London City Council requested the

Division office to modify the project by deleting the Bentleys Creek and relocating the Shaw Cove dike. In addition to this relocation, the city requested that the degree of flood protection be reduced to a 100-year storm frequency which is a minimum requirement for urban renewal areas.

20. 1976 Plan. The plan in 1976 was considered to be the product of economic, local interest and environmental considerations. Little flexibility existed in the alignment selection due to constrictions of shoreline, the main line railroad tracks existing structures and the urban renewal development plans. Only limited areas of the project permitted any variation in the project alignment. In the vicinity of the City Coal Company (Plate 2-4) an extensive investigation was made as to the structure and alignment most suitable to provide the necessary protection. Several variations of structures and alignment were studied. Two of the alignments excluded the tank farm from the area being protected whereas four alignments provided protection for the oil tanks. The plan selected was considered to be the least costly. The plan was also considered to be the most desirable since it minimized potential damage to the oil tanks, and was determined to be more aesthetically pleasing.

21. Selected Plan. Public Law 94 587 dated 22 October 1976 authorized the alternative protection system emphasizing filling part of the Urban Renewal Area in lieu of a dike. The area proposed for regrading included the urban renewal area bounded by Bank Street on the north, Shaw Street on the west and Hamilton Street on the south. The remainder of the project from Sta. 20+00 to Sta. 34+20 would be protected by a dike and walls. One of the requirements of the Division Engineer's recommendations was "that during the preparation of the final design documents, the project configuration may be modified to provide protection to the New London Shaw Cove Urban Renewal Area consistent with the requirements of the Federal Housing and Urban Development Agency, and the City Redevelopment Agency".

At the request of the City, the modified plan has been developed further and is being presented as the plan for implementation (See Plate 2-2). The selected plan would provide protection for a

project design storm of 100-year frequency with design still water at El. 10.5. At the area of regrading, the high point (ridge) would be at El. 12.0 (allowing for 1.5 feet of freeboard) and would follow the perimeter of the harbor. From the high ridge the regraded terrain would slope downward to meet the existing Bank Street grades. The segment between Sta 20+00 and Sta 32+68 includes dikes, circular steel cells with concrete "L" walls, ramp, and concrete "I" and "II" walls. The segment from Sta 32+68 to 34+20 has been changed from a dike section to an I wall section due to space restrictions.

I. DESCRIPTION OF STRUCTURES AND IMPROVEMENTS

22. Description. The protection plan consists primarily of a barrier running from high ground at Hamilton Street on the south end and terminating at high ground at Bank Street on the north end. In general, the alignment follows the shoreline rather closely and is modified as necessary to be (1) compatible with the urban renewal plans, (2) to avoid costly real estate and (3) to provide access to real estate outside the protective works. The top elevation of the barrier from the south end (Sta 0+00) to the Pumping Station (Sta 18+90) will be at El. 12.00 msl and from the Pumping Station to the north end will be at El. 14.5 msl.

23. Regraded Area. In lieu of a dike, the area along the west edge of the harbor is to be protected by means of filling and regrading. The two principal areas of regrading include the area bounded by Howard, Shaw and Bank Streets and the area in the vicinity of the pumping station (See Plate 2-2). The remainder of the low areas south of Bank Street and east of the pumping station does not lend itself to regrading since a number of existing improvements will be allowed to remain within the Urban Renewal Area. For drainage purposes, it was deemed advisable to slope the regraded area from the high ridge along the harbor to the low point along Bank Street. The extent of the regrading will require approximately 60,000 c.y. of fill. It was not considered practical or economical to pitch and drain the area toward the harbor. In addition to the problem of meeting the Bank Street grades, a considerably greater amount of fill would

be required. The harbor face of the regraded area is to be protected with suitable stone protection. A level area approximately 80 feet wide on the cove side of the dike (Plate 2-3) is to be constructed from waste material. The rock necessary to build the low level dike protecting the level area is expected to be obtained from the Phase I construction contract of the pressure conduit.

24. Earth Dikes. Earth dikes will be required between Sta 22+12 and Sta 25+80 and between 25+80 and Sta 29+27.

Sta 22+12 to Sta 25+80. This segment of dike is to be constructed along the existing bank edge with the bulk of the dike extending into the harbor. After excavation of unsuitable material, a dumped rock toe is to be constructed to El +2.0 on top of a dumped sand fill (in the wet). A dumped gravel fill is to be placed between the rock toe and the impervious core which is to be constructed above mean high water. The Shaw Cove side of the dike is to be protected by a gravel bedding and Class "B" armor stone whereas the top and landside of the dike is to be protected with filter cloth and stone protection.

Sta 25+80 to Sta 29+27. This segment of dike is somewhat removed from the water's edge and is to be constructed in the dry. The dike will consist of an impervious core with gravel and Class A armor stone protection on the harbor side, and with filter cloth and stone protection on the landside and top of dike. Thus the integrity of the dike is maintained should overtopping occur.

25. Circular Steel Cell & "L" Wall. An existing wood pier unloading area for oil tankers will be removed and in its place a Circular Steel Cell & "L" Wall will be built. Comparative studies indicated that the combination of a 20-foot diameter circular sheet steel cells with a reinforced concrete L on top was the most practical means of providing protection between the regraded area on the south side of the City Coal Co. and earth dike on the north side of Coal Company. The cells were located as far away from the oil tanks to minimize the possible damage to the tanks. Locating the cells outside the limit of the existing bulkhead line will eliminate the need for excavating old foundations

and driving sheeting through man made fills. The stability inherent with circular cells results in a minimum amount of pile driving for penetration. The concrete cap over the cells at El. 5.0 will serve as the base of the "L" wall. This area will be used for the docking and unloading of oil tankers.

26. Ramp and "L" Wall. To provide access to properties on the Cove side of the barrier, a ramp has been provided (Plate 2-4). Once over the barrier, traffic may proceed along the Access Road running parallel to the railroad and will cross the railroad at locations designated and provided for by the city. A guard rail system will be provided along the railroad to contain traffic. To minimize the interference of the project on the Urban Renewal Project, a "L" wall was utilized at the request of the city.

27. Pressure Conduit. The pressure conduit will intercept flows from Truman Brook in the vicinity of Grand Street as shown on Plate 2-2 and discussed in Appendix C. By means of a 96-inch diameter concrete conduit, flows will be directed from Grand Street southerly along Jefferson Ave., easterly parallel along Bank Street under urban renewal property, and then southerly passing the pumping station on the westerly side and discharging into the cove. An emergency closure gate is proposed for the conduit on the discharge end.

28. I-Walls. Cantilevered I-walls are provided to tie in the concrete walls into the earth dikes as well as to complete the closure to high ground between Sta 32+68 to Sta 34+20. Sheet pile will be used as part of the cantilever wall.

29. Pumping Station.

a. General. The pumping station will be situated behind the barrier at Sta 18+90 (Plate 2-4). The station will consist of reinforced concrete, steel frame and brick facade. The station will be fed by a 72-inch storm drain which during normal conditions water will pass thru the station and under the dike by gravity to the cove. During flooding conditions, appropriate gates will be closed and storm flows will be directed to the station where it will be pumped over the barrier. Installed pumping capacity will be 210 cfs.

b. Equipment. The pumping station will utilize three vertical axial flow pumps driven by diesel engines through right angle gear units. Each pump will have a capacity of 70 cfs (31,420 gpm). The pumps will be suspended in a normally dry sump with motor-operated sluice gates at the entrance. Pumps will discharge in individual lines running over the top of the dike. Past records indicate the local electric power supply is not adequately reliable for reliance on electric motor drives. Because of the lack of ponding area, frequent cycling of the pumps would be necessary during periods of low flow. To alleviate this unsatisfactory condition, a valved by-pass will be provided in the discharge from each pump. Valves will be motor-operated. Normal runoff will be conducted to the ocean by gravity through a 78" x 78" reinforced concrete conduit. The gravity discharge conduit will be provided with a motor-operated sluice gate on the riverside of the dike. The station will be provided with sump pump, heating equipment and hand-operated crane for installation and maintenance of equipment. A small diesel electric generating unit will be provided for station auxiliaries and lighting in event of failure of public utility service.

c. Electric Services. The Hartford Electric Light Company will extend 13,200 volt overhead primary service approximately 250 feet to the pumping station. The utility will provide transformers to transform 13,200 volts to 208/120 volts, 3 phase, 4-wire, 60 hertz secondary. Underground service will be provided from pumping station to the transformer pole.

d. Telephone Service. The Southern New England Telephone Company will extend a cable from Bank Street to the pumping station in an underground conduit.

J. DEPARTURES FROM AUTHORIZED PLAN

30. There are no departures from the project plan as authorized.

K. CONSTRUCTION PROCEDURES AND DIVERSION PLAN

31. Regraded Area. The buildings in the area to be regraded have been removed. Suitable fill is available within a reasonable distance

of the project site. The area to be regraded is free of any diversion problems consequently the construction operation will be relatively simple.

32. Dikes. Construction of the dikes are expected to present no particular problems. Unsuitable material will be removed as necessary and replaced with suitable impervious fill. Placement of the impervious material is expected to be done in the dry. All dikes, except between Sta 22+12 and 25+80 are sufficiently landward of the shore such that no extensive cofferdam system is required. For the segment of dike extending into the Cove (Sta 22+12 to 25+80 on Plate 2-5) the construction procedure encompasses the removal of unsuitable material, replacing it with dumped sand fill, constructing a dumped rock fill section to El. 2.0 and filling behind the dumped rock fill with gravel. Construction above the gravel fill will be in the dry and will present little problems.

33. Circular Steel Cell & "L" Wall. Unsuitable material will be removed as necessary prior to the installation of the cells. The cells will then be constructed as shown on Plate 2-4 by means of a floating plant. As each cell is driven it will be filled with clean granular material. The area immediately behind the cells is to be filled with dumped sand fill and graded to suit the existing terrain. The "L" wall would then be formed and constructed on top of the cells.

34. Pumping Station and "L" Wall at Access Road. Neither structure is expected to present any serious construction problems. Both structures are sufficiently removed from the waters edge such that cofferdams are not needed. Sufficient room exists around the structures to provide the Contractor with freedom of movement. At both locations, unsuitable man made fill must be removed prior to constructing the structures. Ground water is expected to be controlled by pumps or by a well point system such that all work will be performed in the dry.

35. Pressure Conduit. Except for the depth of excavation and certain restricted areas, the construction of the pressure conduit should be routine. It is expected that the construction of the conduit will be initiated at the Cove end and then proceed uphill to Truman

Brook. A small cofferdam will be required at the cove end to permit construction of the outlet structure. Once the outlet structure is completed the installation can proceed inland with little interference from ground water. It is logical to assume that the Contractor will commence at the lowest elevation (Shaw Cove) and proceed upward to Truman Brook. By proceeding in this direction, the drainage is away from the working face; ground water is readily controlled and the risk of flooding equipment is reduced. Excavated earth faces will be adequately braced by structural means in order to protect the workmen as well as protect adjacent buildings.

L. ACCESS ROADS

36. General. The project will be located in a highly urbanized area. All streets leading to the site are congested with local city traffic. Construction vehicles travelling to the site will use the area presently being cleared by the Redevelopment Agency. This congestion by the Contractor will be minimal.

M. CORROSION MITIGATION

37. Corrosion Mitigation. There are two areas where steel sheathing is used:

a. Circular steel cells which support the "L" wall from Station 19+41 to 21+98. The unsuitable materials within the cell area will be removed before driving the sheathing. The interior of the cells will be filled with clean granular material. Dumped sand shall be used as backfill on the landward side. The seaward portion will be exposed to salt water of Shaw Cove. "I" walls using steel sheathing will connect the steel cells to the dikes. All of this piling will be painted with a system 6 - A-Z as defined by Guide Specification CE 1409. In addition, the steel will be protected by a cathodic protection system using sacrificial anodes.

b. Steel sheathing serves as a cutoff for the "L" wall from Station 29+70 to 32+68. "I" walls using steel sheathing will connect the "L" walls to the dikes. The steel sheathing will be painted with a system 6 - A-Z.

Tests have not been made on soil samples because the fill materials are considered to be nonuniform. Water resistivity and PH readings will be taken during the preparation of the feature Design Memo.

N. ENVIRONMENTAL ANALYSES

38. Environmental Quality Aspects of Architectural Design. Architectural design of structures and facilities required for this project will be based upon fulfillment of functional needs and consideration of the adjacent environment within an urban renewal area. Design development will provide an aesthetic value best suited to preserving, maintaining or enhancing the urban quality at the locale of the feature described. Landscaping and other visual amenities, which provide additional aesthetic enhancement to the project will be incorporated during the final design.

The principal structure requiring a studied application of aesthetic criteria is the pumping station. Exterior walls will be composite face brick and concrete masonry units with a minimum of fenestration. Facade and roof detailing will be developed to be compatible with adjacent construction through coordination with the city redevelopment agency. Selective wall texture or feature strips will be incorporated in the design for the exposed surface of the land side face of the concrete L-wall between Stations 29+70 and 32+68.

Public access to the dike for recreation does not seem justified since no unique features are present. Provision for the handicapped are not required in connection with the architectural design. Exterior work in area of public access or use will reflect required criteria.

39. Cultural Resources. In compliance with Executive Order 11593, the National Historic Preservation Act of 1966, the National Environmental Policy Act of 1969 and E.C. 1105-2-37, Identification and Administration of Cultural Resources, the New England Division has conducted and completed a cultural resources reconnaissance. The reconnaissance was conducted by Dr. Frederick Warner of the Connecticut Archaeological Survey. It included a literature search, field reconnaissance and selective subsurface testing of the area to be impacted. No cultural resources were identified within the proposed project area and it was determined that implementation of this project will have no effect on cultural resources.

The State Historic Preservation Office was consulted to inquire as to the presence of any properties listed or eligible for listing on

the National Register of Historic Sites. Since the New London Hurricane Protection Project is being planned in conjunction with a current urban renewal project of the Housing and Urban Development Authority, the SHPO was also consulted to determine that the Corps' responsibilities include only those areas to be impacted by construction of the hurricane barrier and that there are no historic and/or archaeological sites of National Register eligibility in this area.

Upon final review and acceptance of Dr. Warner's report, copies will be furnished to the State Historic Preservation Officer and the National Park Service for review and comment.

O. REAL ESTATE REQUIREMENTS

40. Real Estate. Right-of-way requirements and real estate costs which are detailed in Appendix A, "Preliminary Estimate of Real Estate Costs."

Estimated costs are summarized as follows:

Lands and Improvements	\$714,120
Temporary Construction Easements	33,600
Severance Damages	24,000
Relocation Assistance Costs	3,600
Acquisition Costs	30,000
Contingency Cost 20% of 805,320)	<u>161,064</u>
TOTAL	\$966,384
Use	\$970,000

P. COST ESTIMATES AND COST APPORTIONMENT

41. General. Estimates of cost include all features for completion of the project and are based on computed quantities and unit prices current as of May 1977. A detailed breakdown of the estimate for

each feature, contingencies, engineering and design, and supervision and administration for both Federal and non-Federal costs, is given in Table No. 9.

42. Comparison of Estimates. Table No. 8 outlines and explains the changes.

TABLE 8

COMPARISON OF ESTIMATES

Project Feature	Original Project		Revised Project		
	Project Document 1961 Price Levels	GDM Jan 66	Supplemental Authorization Modification (P. L. 94-587) Oct. 75 Price Levels	Last Estimate to Congress, FY-78 Budget, 1976 Price Levels	Current Estimate May 77 Price Levels
01. Lands & Damages	\$ 180,000	\$ 535,000	\$ 300,000	\$ 300,000	\$ 970,000
02. Relocations	30,000	60,000	3,160,000	105,000	45,000
11. Levee & Floodwalls	2,167,000	4,006,000	1,290,000	3,350,000	3,200,000
13. Pumping Plant	544,000	499,000	1,870,000	1,410,000	1,055,000
15. Pressure Conduit				2,040,000	1,620,000
19. Bldg. Grds. & Util.		15,000	0	0	0
Engineering and Design	271,000	345,000	585,000	595,000	610,000
Supervision and Administration	238,000	395,000	540,000	550,000	500,000
TOTAL COST	3,430,000	5,840,000	7,745,000	8,350,000	8,000,000
Total Federal Cost	2,401,000	4,088,000	5,425,000	5,850,000	5,600,000
Non-Federal	1,029,000	1,752,000	2,320,000	2,500,000	2,400,000

1. The cost increase between the project document and the January 1966 General Design Memorandum was based on price escalation and design refinement. The then authorized project (1966) consisted of two (2) offshore barriers, Bentleys Creek and Shaw Cove.

2. The estimate used in the Supplemental Report and included in the legislation modifying the authorized project (\$7,745,000) reflected the deletion of Bentleys Creek and relocation of the Shaw Cove barrier to the shoreline of the cove.

3. The change from the supplemental report to the last estimate submitted to Congress (\$8,350,000) reflected price level escalation.

4. Due to reauthorization and restudy of the project for urban redevelopment, the current estimate reflects detailed design refinements as follows: (a) Increase in Real Estate cost reflects the cost of the land for the berm to support the regraded area for the renewal project, (b) Levee and floodwalls costs were reduced due to design refinement, (c) Pumping plant was reduced due to a reduction in required pumping capacity, (d) S&A reflects a re-analysis of requirement based on a lower construction cost.

TABLE 9

DETAILED COST ESTIMATE
(May 1977 Price Levels)

Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
<u>Lands & Damages</u>				\$ 970,000
<u>Relocations</u>				
Utilities	1	Job	L.S.	\$ 45,000
<u>Levees & Floodwalls</u>				
<u>Dike</u>				
Site Preparation	1	L.S.	10,000.00	\$ 10,000
Removal of Structures	1	Job	L.S.	6,000
General Excavation	21,300	C.Y.	6.80	144,840
Compacted Impervious Fill	32,000	C.Y.	9.00	288,000
Compacted Sand Fill	200	C.Y.	9.40	1,880
Dumped Waste Fill	61,500	C.Y.	2.50	153,750
Dumped Impervious Fill	33,500	C.Y.	4.00	134,000
Compacted Gravel	400	C.Y.	9.00	3,600
Dumped Gravel	3,500	C.Y.	6.00	21,000
Dredging	12,000	C.Y.	20.00	240,000
Dumped Sand Fill	9,400	C.Y.	5.00	47,000
Dumped Rock	10,700	C.Y.	22.00	235,400
Gravel Bedding	3,100	C.Y.	9.50	29,450
Filter Cloth	7,800	S.Y.	4.00	31,200
Bedding Stone	300	C.Y.	30.00	9,000
Sand Cushion	100	C.Y.	6.00	600
Stone Protection	1,600	C.Y.	30.00	48,000
B Armor Stone	3,000	C.Y.	30.00	90,000
A Armor Stone	1,000	C.Y.	30.00	30,000
Road Gravel Base	500	C.Y.	9.00	4,500
Bit. Conc. Base	1,900	S.Y.	9.00	17,100
Bit. Conc. Pavement	1,900	S.Y.	7.00	13,300
Bit. Conc. Sidewalk & Curb	200	S.Y.	12.00	2,400
Galv. Steel Guard Rail	300	L.F.	11.00	3,300
Landscaping	1	Job	L.S.	55,000
Sub-Total				\$1,619,320
Contingency				340,680
TOTAL				\$1,960,000

Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
<u>Levees & Floodwalls (Cont'd)</u>				
<u>Walls</u>				
Excavation, Structural	16,500	C.Y.	6.80	\$ 112,200
Compacted Sand Fill including Foundation Treatment	2,200	C.Y.	14.00	30,800
Dumped Earth Fill	1,600	C.Y.	2.80	4,480
Steel Sheet Piling	14,300	S.F.	17.50	250,250
Steel Sheet Piling (Cells)	21,000	S.F.	12.30	258,300
Cell Fill	3,400	C.Y.	12.00	40,800
Reinforced Concrete I-Wall	300	C.Y.	260.00	78,000
Reinforced Concrete L-Wall	1,000	C.Y.	230.00	230,000
Dumped Sand Fill	2,300		5.00	<u>11,500</u>
	Sub-Total			1,016,330
	Contingency			<u>223,670</u>
	TOTAL			3,200,000
<u>Pressure Conduit</u>				
96" R.C. Pipe	2,750	L.F.	400.00	1,100,000
Excavation Earth	18,300	C.Y.	10.00	183,000
Rock	2,000	C.Y.	20.00	40,000
Pavement Repair	600	S.Y.	20.00	12,000
Maintain & Control Traffic	1	Job	L.S.	<u>66,800</u>
	Sub-Total			1,401,800
	Contingency			<u>218,200</u>
	TOTAL			1,620,000
<u>Pumping Station</u>	1	Job	L.S.	875,000
	Contingency			<u>175,000</u>
	TOTAL			\$1,050,000
	Total Construction			\$6,885,000
	Engineering and Design			615,000
	Supervision & Administration			500,000
	Total Project Cost			\$8,000,000

TABLE 10

Apportionment of Costs

Non-Federal Costs

Lands & Damages		\$ 970,000
Relocations		45,000
Cash Contribution (30% of Project Costs Less Lands & Damages)		<u>1,385,000</u>
Non-Federal Cost	Total	\$ 2,400,000
Federal Funding		\$ 5,600,000
	Total Project Cost	\$ 8,000,000

43. Annual Costs.

The estimated annual costs are as follows:

1. Federal Investment

a. Federal First Cost	\$ 5,600,000
b. Interest During Construction (1a x 0.06125 x 1/2T) (T=2 yrs)	<u>343,000</u>
c. <u>TOTAL FEDERAL INVESTMENT</u>	\$ 5,943,000

2. Federal Annual Charges

a. Interest (1c x 0.06125)	\$ 364,009
b. Amortization (1c x 0.00013)	<u>773</u>
c. <u>TOTAL FEDERAL ANNUAL CHARGES</u>	\$ 364,782
	Use \$ 366,000

3. Non-Federal Investment

a. Contributed Funds	\$1,385,000
b. Relocations	45,000
c. Lands, Easements	<u>970,000</u>
d. <u>TOTAL NON-FEDERAL FIRST COST</u>	\$2,400,000

4. Interest During Construction

a. Interest (3c x 0.06125)	\$ 147,000
b. <u>TOTAL NON-FEDERAL INVESTMENT</u>	\$2,547,000

5. Non-Federal Annual Charges

a. Interest (\$2,547,000 x 06125)	\$ 156,004
b. Amortization (.00013)	331
c. Maintenance and Operation	<u>9,200</u>
d. <u>TOTAL NON-FEDERAL ANNUAL CHARGES</u>	\$ 165,534

	Use	\$ 166,000
6. TOTAL ANNUAL CHARGES - 2c +5d		\$ 531,000

$$\text{B/C Ratio} = \frac{663,300}{531,000} = 1.2$$

Q. SCHEDULE FOR DESIGN AND CONSTRUCTION

44. Design.

Subsequent to the approval of the GDM a feature design memorandum will be prepared and submitted for approval. Included in the feature will be structures, embankment and foundations and corrosion mitigation. This DM will be submitted in October 1977. Upon approval of this Memorandum, the following is proposed:

a. Plans and specifications for the pressure conduit designed by the A-E from Garibaldi Square to the Cove for the City of New London will be reviewed and issued to prospective bidders as Phase I construction contract.

b. Contract plans and specifications for a Phase II construction contract will be prepared. It is expected that plans and specifications will be completed late in Fiscal Year 78. A Phase II construction contract could be awarded early in Fiscal Year 1979.

45. Construction.

a. Pressure Conduit. - Since new development in the Urban Renewal area is being stymied until the pressure conduit is installed, the City of New London is anxious to install the 96" conduit as soon as possible from Garibaldi Square along Bank Street to the Cove. Bank Street is a main thoroughfare thru the City of New London and the redevelopment area provides choice property development. The City of New London has engaged the services of an A-E to design this portion of the conduit for them in accordance with Corps criteria. The A-E's report, design and estimate are inclosed in Appendix C. Upon approval of this DM it is this Division's intent to review the plans and specifications for the conduit and issue for bids a Phase I construction contract.

The upper portion of the conduit from Garibaldi Square to Truman Brook will be built with the main contract as a Phase II construction contract. Phase I construction could start in the Fall of Calendar Year 1977.

b. Barrier. It is estimated that it will require two years to build the protective barrier. It is assumed that the contract will be awarded in early Fiscal Year 1979, the 1st construction season. The phases of construction are briefly outlined below; whereas, the details of construction are more clearly discussed on Page No. 39, "Construction Procedures and Diversion Plan."

(1) First Construction Season. - The contractor will be required to start constructing the pressure conduit. It is expected that he will also concentrate on the pumping station, circular steel cells with "L" walls, and the "L" walls at the

Access Road during the first construction year. At the pumping station the Contractor is expected to complete by winter the excavation, installation of his ground water control system, placing of concrete and complete the superstructure shell. During the second winter time he will proceed to install the necessary equipment in the pumping station. Simultaneously, in the vicinity of the City Coal Company, the Contractor is expected to initiate work on the system of steel cells and "L" wall. He is expected to remove the unsuitable material in the fall, take approximately 3 months to erect and fill the steel cells and spend the remaining months of the first construction season forming and placing the concrete "L" wall on top of the cells. the "L" wall in the vicinity of the Access Road (Sta 29+70 to 32+68) is sufficiently removed such work could be initiated at any time during the first season. Undoubtedly, the Contractor would more than likely elect to complete the "L" walls in this reach as soon as possible so that he can reuse his forms for constructing the "L" walls on top of the cells

(2) Second Construction Season. The major effect during the second season will be spent on completing the "L" walls on top of the cells, completing the pressure conduit and constructing the various segments of dikes thereby completing the protective system. The rate of construction is expected to proceed rapidly since the dikes are relatively small and that he can initiate construction of the dikes in several locations simultaneously. As construction of the dikes progresses, the Contractor is expected to follow up with final grading, landscaping and cleanup.

R. OPERATION AND MAINTENANCE

46. General. Revised plans of the original design have reduced the work loss but costs have increased since 1966. O&M of the proposed project would be \$9,200.

47. Estimated Cost. Estimate a crew of 1 Supervisor or (Superintendent) and one Laborer. Operation of the pumping station, inspection and maintenance, 1 week per month, with exception of full time during periods of hurricane alert or abnormal high tides. Assume 38 hours extra time for such periods.

a. Salaries.

1 WB-08 (1 week x 12 months x 8 hrs + 38 hrs = 134 hrs)
134 hrs x \$6.09 = \$816.00
1 WB-05 (1 week x 12 months x 8 hrs + 38 hrs = 134 hrs)
134 hrs x \$5.55 = \$744.00

b. Maintenance.

(1) Concrete repairs	\$ 600.00
Graffiti removal	
Joint repairs	
Vandalism	
(2) Stone replacement 200 c.y. @ \$20.00	\$4,000.00
Vandalism	
Washouts	
(3) Herbicide treatment	\$1,000.00
(4) Shaw Cove Pumping Station	\$2,000.00
Minor repairs	
Equipment or plant replacement	
Painting	
Lubrication	
Snow removal	
Total a & b	\$9,160.00
Use	\$9,200.00

S. ECONOMICS

48. Introduction. Located at the mouth of the Thames River, New London lies approximately halfway between Boston and New York City. The city is well served by major thoroughfares in relation to the Southeastern Connecticut Region and the primary population centers along the southern Connecticut coastal areas. The two principal arteries, which provide easy access to all parts of New York and New England, are Interstate Route 95 and the Connecticut Turnpike (Route 52). The former passes

through the city in an east-west direction and the latter runs west of New London and then north through Norwich. On a regional basis, Interstate Route 95 provides direct access between the three communities which form the core of the Southeastern Region. Its position between Groton and Waterford constitute a major transportation and locational asset.

The two major railroads in the region furnish the area with good public transportation. The main line of the shore route of the Consolidated Rail Corporation railroad passes through New London. The Central Vermont railway, a freight hauler, has its terminal in New London and provides access to western Massachusetts, Vermont and Canada.

New London is geographically one of the smallest communities in Connecticut; yet the population density is exceeded by only four other cities in the State. Despite its small population, the city resembles an urban center surrounded by suburbs. It has historically enjoyed the benefits of a strategic location in Southeastern Connecticut. This has been visible by the community's present land use pattern, intensity of development, and population density.

The New London Redevelopment Authority has proposed an Urban Renewal Project which will encompass approximately four blocks in the Shaw Cove area of New London. Land to be acquired under this proposal will receive location benefits upon the completion of the urban renewal and will be protected from flooding upon the determination of the Corps solution. The area is bounded by Banks, Shaw and Hamilton Streets, New London Harbor, and the main line of the Consolidated Rail Corporation railroad running from Boston to New York. This area, one of the oldest parts of town, has changed character several times. It consisted of low yield commercial and industrial establishments along the cove surrounded by residential units which are in need of varying degrees of repair. The area has already been evacuated, and all of the buildings have been razed in anticipation of the urban renewal project.

The Shaw Cove area was essentially the ghetto section of New London. One-third of the residents in the area were black or Spanish speaking people; another one-third were elderly, retired, poor, white people. Although there are other members of minority groups scattered throughout the city, this area accounted for the heaviest minority concentration. The ghetto area was economically self-contained with most residents generally unskilled and either working in the immediate area or unemployed. Absentee landlords were a common feature. As a result few homes were properly maintained and improvements were rare. Shaw Cove was a conglomeration of marginal waterfront and peripheral commercial property, minimal manufacturing and substandard, overcrowded residential structures. This combination of structures was unacceptable according to current land use standards and the condition of the structures themselves indicates that the area would benefit from land use planning.

The city plans call for developing a marina in Shaw Cove with accompanying boating and personal service facilities. Inland, retail stores and commercial service establishments are planned. Real estate and local business interests will benefit most directly from the renewal project. In addition, the presence of new businesses will strengthen the tax base of local government, especially as many of the older, displaced businesses are relocating in the city. An upgrading of the residential area beyond Shaw and Hamilton Streets will be attempted through the Urban Renewal Programs Concentrated Code Enforcement Program. This program combines strict enforcement of neighborhood building codes with 3 percent interest loans to owners of residences or businesses to aid them with compliance. This area was originally scheduled for inclusion in the renewal project but withdrawn due to funding constraints. The upgrading program will mean improvements for homeowners and tenants in the area.

The project is being financed by the Department of Housing and Urban Development on a 70 percent Federal - 30 percent local ratio. Urban Renewal funds for the first year of the project, commencing on July 1, 1974 will be about \$3.5 million and the total cost of the project over seven years will be \$20.5 million.

The renewal project is premised on a Corps project proposal previously authorized which will make the area flood free up to the 100 year flood elevation. When completed, the urban renewal project will make 56 acres of land available, most of which is prime commercial with some limited residential property. The Corps alternative solutions to the flood problem have been evaluated under strict adherence to the principle of "with" and "without" project analysis. The "with" condition is defined in terms of what is most likely to occur within the area under a specified plan. The "without" condition refers to what is most likely to occur in the absence of a hurricane tidal flood control plan.

The focal point of the renewal project will be a marina development including 14 acres of cove waters. With its close proximity to the central business district, the marina is expected to provide the favorable environment for both the commercial and residential development in the project area. With excellent railroad service to New York City and new ferry service planned to Long Island, the recreation and tourist industry add a new dimension to the future prosperity of New London. The shore line of the Consolidated Rail Corporation railroad provides two hour service to New York City; and the estimated travel time by ferry to Long Island should be only one hour. Vacationers from both areas are expected to use the facilities at Shaw Cove; a modern and enlarged marina with its complimentary commercial businesses would encourage not only more tourism but also more frequent patronage by the local residents. The capacity of the wharves to dock boats will increase from 65 to about 450 slips.

The following sections discuss the benefits to be derived from construction of the proposed Shaw Cove, New London hurricane tidal flood control project. They contain the technical, economic, and social considerations used in analyzing and, when possible, quantifying the potential benefits attributable to the proposed project. The ensuing section discusses the socio-economic profile of the New London area and provides a general understanding of its resources, development, economics, problems and needs.

49. Socio-Economic Profile. Since 1951, the lack of developable land in New London has been clearly evident with only 8 percent of the city's land underdeveloped. Because of this scarcity of developable land, the anticipated future demand should consist of both medium and high density residential usage, with a corresponding demand for commercial property. If new development is to occur, it must be through the intensification of existing uses or through the ability of New London to clear its deteriorating areas, like Shaw Cove, in order to accommodate new and more productive developments.

With the rapid growth rates which have characterized the neighboring communities of Groton and Waterford, New London's market potential for high density residential and commercial development may be in serious jeopardy. Should New London be unable to provide new developable sites, the present centralized regional development pattern could become diffused, to the detriment of the entire area.

Between 1910 and 1970, New London increased its population from 19,659 to 31,630. This represents a change of 61.2 percent. Until the mid-1960's, New London was the second largest community in the Southeastern Connecticut Region. Today it is surpassed by Norwich which has had less than half the growth rate of New London and Groton whose labor force is almost equally split between civilian and military personnel.

Historically, New London has led the population growth and development of the coastal area while Norwich has led the northern portion of this region. On a combined basis, New London and its adjacent neighbors of Groton and Waterford had a population concentration of 87,400 or 42 percent of the New London-Groton-Norwich SMSA in 1970. In the past decade, New London's population declined by 7.5 percent while the two other communities registered large gains.

Some of the reasons for this decline include (1) the lack of developable land for residential use; (2) the non-marketability of obsolete housing units; (3) migration of large families to the suburbs; and (4) an increasing demand for non-residential land use. Thus the population decline is not due to adverse

economic conditions, but rather to the lack of available land for new residential construction. As most central cities in the past 15 years, New London has shown a slight decline in total population. This past and possible future population loss is not the significant question; what is important is the city's ability to retain and expand its historic position as the service and commercial center of the SMSA.

The recent decline in population has been explained as a consequence of a limited housing supply which encouraged families with children to move to suburban areas. However, this decrease in population is consistent with other changes which are commonly associated with aging city centers. There have been increases in the over 65 and under 18 age groups in the population; the black population has increased from less than 8 percent of the total in 1960 to over 11 percent in 1970; and suburban shopping facilities were reportedly beginning to make inroads into the business of downtown establishments.

TABLE 11

POPULATION CHARACTERISTICS

	<u>Without Development</u>		<u>With Development</u>	
	<u>Population</u>	<u>Percent Share of Southeast Region</u>	<u>Population</u>	<u>Percent Share of Southeast Region</u>
1920	25,688	26.0	25,688	26.0
1960	34,182	19.5	34,182	19.5
1970	31,630	14.0	31,630	14.0
1980	33,800	12.7	37,000	13.9
2000	38,000	11.5	44,000	13.3

SOURCES: U. S. Department of Commerce, 1967 New London, Connecticut Master Plan Program

TABLE 12

1970 SOCIAL PROFILE OF POPULATION

	<u>State^a</u>	<u>New London^b</u>	<u>Shaw Cove^c</u>
Population	3,031,705	31,589	440
Percent foreign born	8.6	8.4	N. A.
Percent foreign stock	23.4	21.4	N. A.
Percent Black	6.0	11.2	34
Percent Spanish-lang.	2.4	2.8	8
Percent under 18	16.5	25.6	N. A.
Percent over 65	5.7	10.9	33+

SOURCES: a, b. U. S. Dept. of Commerce
 c. Project Relocation Report (Revised) Shaw Cove
 Urban Renewal Area Conn. R-126-All figures
 approximate.
 + Personal communication

Italians are the major ethnic group supplemented by those of English, Irish, Canadian, Hungarian and Polish origins. Some businesses oriented to the Spanish-speaking population are being established but as yet this group comprises less than 3 percent of the population.

In 1920, New London's population comprised 26 percent of the total population in the Southeastern Connecticut Region. In 1960 New London's share of the Region's total population had declined to 19.5 percent. By projecting a similar 40 years with some adjustment, New London would constitute 11.5 percent of Region's total population by the year 2000 or 38,000 persons. In the event renewal activities increase along with substantial apartment development, New London's share of population would increase to 13.3 percent.

In 1970, there were 73,000 civilian jobs available in the southeastern Connecticut region. In addition to these jobs, there were 15,000 employees stationed at the Navy Base and

the Coast Guard Academy in Groton. Manufacturing jobs were 28,600 or 38 percent of the employment. Manufacturing has declined in relative importance in the last several decades.

Today the regions economy is highly dependent on defense. The Southeastern Connecticut Regional Planning Agency has estimated that 39 percent of the total regional population is dependent on defense and that income derived from defense employment in 1973 was over 40% of the region's total income. The multiplier effect of retail purchases of defense employees increases further the importance of the defense sector of the economy of the region.

New London's economic base has also changed over the years. The textile industry, which dominated the economy in the early 1900's has been replaced by the defense industry and retail services.

In 1970, manufacturing employment in New London accounted for 27 percent of the labor force. This was less than the 38 percent reported for the New London-Norwich labor market area. In the city, the percentage of non-manufacturing employment in the retail and personal and related services is 68 percent. This is considered high in comparison with the national norm of 45 - 55 percent. The present ratio for the city indicates that New London is serving a much larger population than is contained in the city proper. Furthermore, this is an indication of the city's past and continuing role as a regional retail and service center. During 1974 and 1975, non-manufacturing growth is expected to continue as new commercial developments will be required to meet the needs of an expanding factory work force in the labor market area. Although retail services have played an increasingly important role in New London's economy, there has been a shift in recent years in retailing patterns from New London to outlying communities due to lack of developable land in the city and the blighted conditions of existing commercial buildings, such as those that existed in the Shaw Cove Area.

Today, New London has a higher than state average proportion of employed residents. However, New London families have lower than average incomes. In 1970, the median family

income for New London was \$9,657, about 82 percent of the state's median income. Altogether the city has a larger percentage of families below the "poverty level"* (10.2% compared to 5.3% for the state), and a smaller percentage of upper income families (20.9% compared to 31.1% for the state). These differences are partly a reflection of the types of jobs available in New London, many of which are in the relatively low-paying service industries.

In 1970 the income of residents of the Shaw Cove area was \$6,120 significantly lower than the median family income of the rest of New London, and less than half of the state median. Only 3% of the area's families were in the \$14,400+ category. The area was economically self-contained with most residents working in the immediate area or self-employed.

50. Future Without Project. Without flood control measures, the study area would be subject to continued periodic flooding. The New London Redevelopment Authority would be forced to abandon its urban renewal project as it would not receive HUD funding. The Shaw Cove area has already been evacuated, and all of the buildings have been razed in anticipation of the urban renewal project. Without urban renewal, the Shaw Cove area would be subject to New London's flood plain zoning restrictions which prohibit the construction of residential units in the area, and discourage the commercial and industrial development by requiring that all buildings be flood proofed to provide protection at a 100-year storm level. Flood proofing, which generally consists of isolating individual buildings with walls, bricking up cellars or raising buildings, is not an attractive solution to flood protection as it has limited protection capacity and is usually quite costly. Without the urban renewal project, which depends upon the implementation 100-year flood protection measures being developed by the Corps, the land in the Shaw Cove section will remain underutilized.

*Poverty statistics are taken from the U. S. Dept. of Commerce, General Social & Economic Characteristics, Conn. 1970. As defined by the Bureau of the Census, "poverty level" is an index adjusted by such factors as family size, number and age of children and sex of family head.

In recent years, New London's population has declined due to its limited housing supply. In addition, the city's ability to retain and expand its historic position as the services and commercial center of southeastern Connecticut is becoming questionable. New development is needed to arrest the city's population decline and maintain its economic status. If new development is to occur, it must be through intensification of existing land uses or through the ability of New London to clear its deteriorating areas like Shaw Cove, in order to accommodate new and more productive developments. Underutilization of land in the Shaw Cove area would not comply with New London's growing development needs, and therefore lead to an eventual decline in economic activity.

No attempt has been made to estimate future flood damages based on the assumption that the urban renewal project would not be implemented and that land in the Shaw Cove area would remain underutilized. A damage and benefit analysis was performed considering the urban renewal project in place. Properties to be protected by the Corps flood control project include the development planned by the New London Redevelopment Authority (45 acres) and 11 acres of properties adjoining the project area. Stage-damage and damage frequency curves were developed for the proposed urban renewal site development. These curves were based on depth-damage information for developments similar to that proposed for the Cove. The redevelopment agency furnished information relative to the type and value of property expected to be constructed. Estimates of average annual benefits were then derived from future damage-frequency curves.

A survey of actual flood losses in the area were made by damage analysis in 1968. Based on March 1977 price levels, the reported estimated total damages from the 1954 flood amounted to \$3,180,000. These losses include damages to the 11 acres of land which are on the perimeter of the urban renewal site. With a repeat of the 1954 flood, losses in the perimeter area are estimated to be \$691,000. Total damage at +3 stage level could be as high as \$7,738,000.

The damages for the Redevelopment Area are project to be substantially more than those previously caused by the 1954

flood. Historical experience has indicated that damages, for a given degree of physical flooding, tend to increase over the time. This development factor is the product of two trends; (1) items of greater value are produced and found in the flood plain as technology becomes more advanced; and (2) increased development occurs in the flood plain in response to growing population pressures. With the intensive outgrowth of commercial activity, Shaw Cove urban renewal area will be no exception to those trends.

Without the Corps solution, average annual future damages to the new property are estimated to be \$728,000 inside the renewal area. Thus, total annual losses would be \$808,000.

51. Future With Project. With the implementation of flood protection measures developed by the Corps, the "most probable future" for the Shaw Cove area will be redevelopment. The New London Redevelopment Authority has already initiated an Urban Renewal Project which will encompass approximately four blocks in the Shaw Cove area. When completed, the urban renewal project will make 45 acres of land available for development. The city has already established agreements with outside interests for the development of the area. A modern and enlarged marina with accompanying boating and personal services facilities is planned for the shoreline, and, inland, retail stores, commercial service establishments and residential units are planned. New water, sewer and utility lines will be constructed to replace older, poorly maintained lines.

Under with-the-project conditions, future annual flood control benefits are estimated to be \$597,200. Benefits to the property to be constructed, discounted to the base year at 6-3/8 percent, were projected to be \$545,000. An amount of \$52,200 would be received by the peripheral outside area and existing property in the protected area that will not be acquired by urban renewal.

External economies will be realized as the Shaw Cove renewal project is expected to extend benefits to other areas. One area is located on the periphery of the Central Business

District (CBD). One half of this district is part of the Winthrop Urban Renewal Project which is now under construction. The remaining portion of the CBD lies between both urban renewal areas and is expected to be favorably effected by the spinoff from the surrounding developments. Likewise, the CBD should receive benefits from the tourist trade attracted to the marina facilities and the proposed industrial-commercial office complex. Redevelopment benefits, according to Senate Document No. 97 of the 87th Congress, were estimated based on the value of labor and other resources required for project construction only. In this case, no benefits were considered for labor engaged in project operation and maintenance as the need is expected to be small and the work will most likely be handled by the regular public work force of the community. Annual redevelopment benefits were estimated at \$66,100. Thus, total annual benefits (flood control and redevelopment) of the project would be \$663,000.

TABLE NO. 13

TOTAL BENEFITS

1. Flood Damage Reduction

- A. Peripheral & Coat Yard (current) \$ 52,200
- B. Urban Renewal (Future) 545,000

Subtotal \$597,200

2. Redevelopment 66,100

Total \$663,300

52. Impacts of the Hurricane Tidal Flood Control Project. The impacts of the Corps project can be most usefully assessed as an element in the overall plan for the renewal area. The city of New London has developed its renewal plans in conjunction with the Urban Renewal Authority and other agencies. The flood protection project will not directly affect the early stages of the renewal program although the program is premised on hurricane tidal flood control being accomplished. Flood protection

will make it possible to clear and redevelop the land in the renewal area in accordance with city plans. Without flood protection the renewal area is likely to remain vacant after it is cleared to be redeveloped on a lower yield basis. Real Estate interests, local businessmen, and taxpayers will benefit from successful redevelopment in accordance with city plans. Residents and homeowners in the adjacent area will live in an improved neighborhood as a result of both flood protection and the building code enforcement program.

53. Selected Plan. A description of the selected plan is covered on page 35.

When the removal project is completed, a wider relocated Howard Street will improve access and road transport to the downtown area for residents below Hamilton Street. There may be highway related adverse impacts in the form of faster and/or heavier traffic. The presence of stores and services on the new Howard Street will offer shopping facilities and possible long-term sources of employment for the lower-income residents of the area. Residents will also benefit from improvements in housing quality if upgrading efforts are successful.

The immediate negative impacts that may result from displacement, such as the break-up of a neighborhood and the creation of new pockets of impoverishment elsewhere in the city, are outside of the Corps jurisdiction. Long-term potential negative consequences are in the sphere of social equity. Successful redevelopment of the renewal project may cause land values in the surrounding area to increase markedly, forcing the remaining low-income residents out of an area convenient to the downtown business district. Here too, responsibility for preventing this outcome rests with the city and its redevelopment agency. Economic dislocation will result from the removal of low-cost housing and its replacement by a smaller number of high-cost units. Responsibility for insuring an adequate supply of low-cost housing rests with city government and related State and Federal agencies.

54. Summary. In summary, the specific flood control project has minor adverse impacts. These are construction noise and

traffic, and aesthetic impacts which can be mitigated by engineering techniques. The major beneficial impact is hurricane tidal flood control, which is an essential element in the redevelopment program. The economic resources that the renewal area generates will provide beneficial impacts. The major adverse impacts of the total renewal program are that it displaces a poor, elderly and disproportionately black and Spanish-speaking population and reduces the city's supply of low-income housing. These adverse impacts may be mitigated somewhat by the work of the city's relocation agency and by the availability of special program funds to insure that relocated households have standard quality housing. The elimination of an area of poor quality housing cannot be judged beneficial without studying the consequences for the displaced population, their perceptions and the views of residents in the surrounding area.

55. Alternate Plans. Section H of this memorandum described all other structural and non-structural plans studied.

56. Flood Proofing. This alternative, which generally consists of isolating individual buildings with walls, bricking up cellars or raising buildings has limited protection capacity. Many of the buildings in the area have deteriorated to a point where their destruction is necessary under the urban renewal program. Thus protection of these buildings at a 100-year storm level does not appear economical or practical.

T. STATEMENT OF FINDINGS

57. Statement of Findings. I have reviewed and evaluated, in light of the overall public interest, the documents concerning the proposed action, as well as the stated view of other interested agencies and the concerned public, relative to the proposed New London Hurricane Protection Project, New London, Connecticut.

The possible consequences of these alternatives have been studied according to environmental, social well being and economic effects, including regional and national development and engineering feasibility.

In evaluation, the following points were considered pertinent:

a. Environmental Consideration - From an environmental standpoint, I have selected the optimum plan which will afford more enhancement than adverse effects. The recommended project will have beneficial effects on flood control, recreation and urban development. The impact of the recommended project is a part of the urban redevelopment and is adequately covered in Environmental Impact Statement. Very little of a natural environment remains and no possibility exists for a reversal on the urbanization process. Beneficial effects will be to make the blighted area available for development and minimize the danger of flooding. The project offers no benefits to Fish and Wildlife resources, nor will it have any adverse effects on these resources. No adverse environmental effects are known or anticipated if the project is built. Measures will be taken to minimize any siltation or turbidity that may occur during construction. The land fill area will be topsoiled and seeded as a dust control measure.

b. Social Well Being Consideration - I find the overriding social well being consideration in the New London Area is the reduction of the flood hazard that has caused damage and human suffering as well as restricting normal and higher utilization of land within the city. Construction of the Hurricane Protection Project will make possible higher utilization of the area for planned urban renewal and redevelopment projects, which will improve the physical and social environment of not only the project site but the entire City of New London. Successful redevelopment of the renewal project may cause land values in the surrounding areas to increase markedly.

c. Engineering Considerations - From an engineering standpoint, I am recommending a project that was found to be the most practical method of meeting the flood control needs for the City of New London. The project was designed for 100-year storm frequency which is a minimum requirement for urban renewal areas. The non-structural solution for the south portion of the project received whole hearted support from local interests. Other considered project alternatives including a water barrier did not meet the criteria and requirements for various economic, social and environmental reasons.

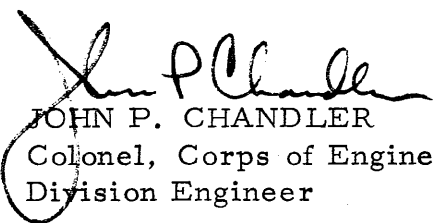
d. Economic Considerations - From an economic standpoint, I have selected the economically optimum plan by providing tidal flood protection and economic growth. The recommended project will have a net effect of increasing employment, tax revenue and stimulate growth in the protected area.

e. Other Public Interest Considerations - I find that the desires of local interests as well as the repeated requests for a non-structural solution are feasible and economically justified. The recommended hurricane protection project will enhance the social well being and economic and environmental aspects in the New London area.

I find that the proposed action as developed in this Memorandum and Recommendations is based on thorough analyses and evaluation of various practicable alternative courses of action for achieving the stated objectives; that wherever adverse effects are found to be involved they cannot be avoided by following reasonable alternative courses of action which would achieve the congressionally specified purposes; that where the proposed action has an adverse effect, this effect is either ameliorated or substantially outweighed by other considerations of national policy; that the recommended action is consonant with national policy, statutes, and administrative directives; and that on balance, the total public interest should best be served by the implementation of the recommendation.

Date

21 July 1977


JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

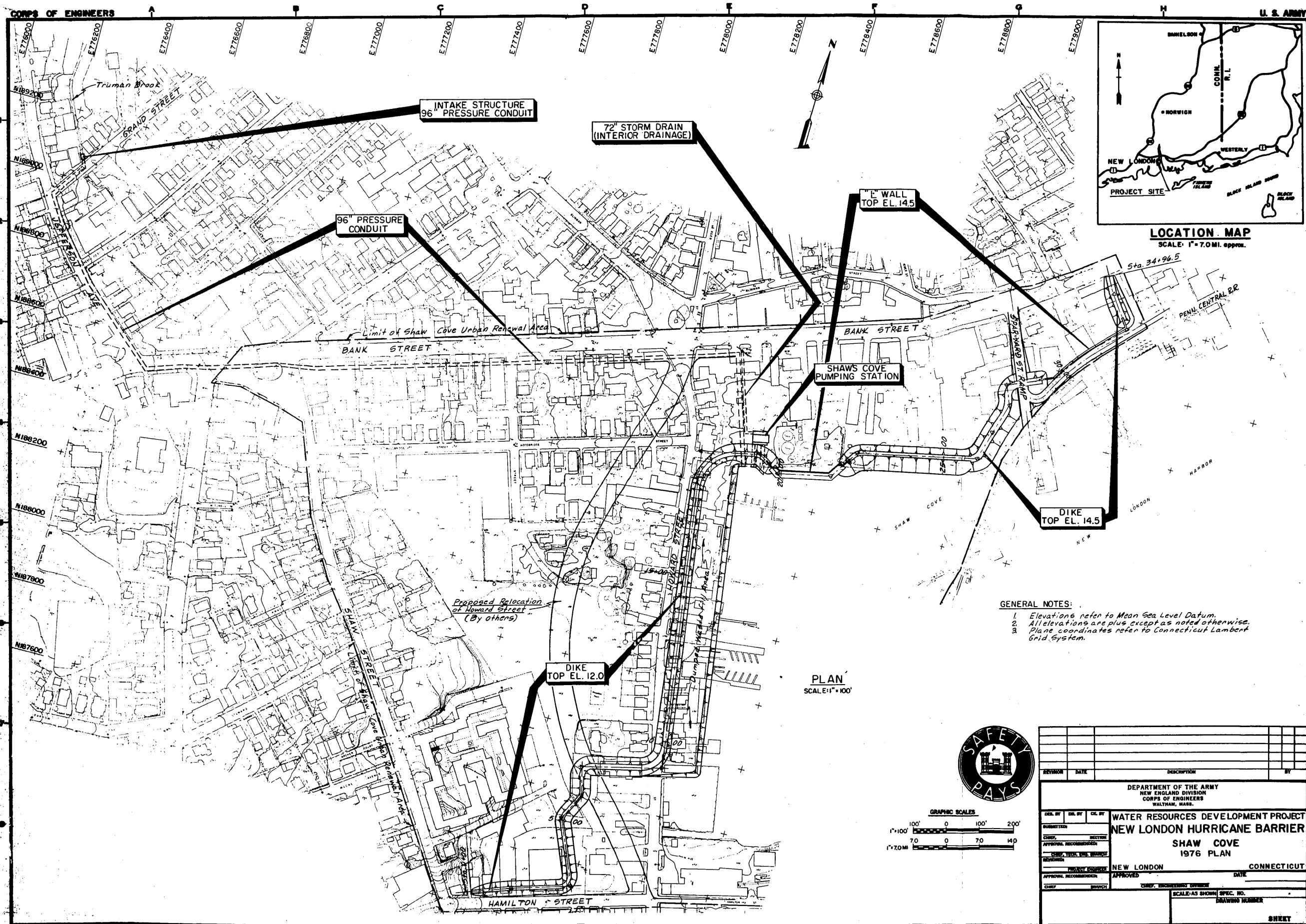
U. ENVIRONMENTAL IMPACT STATEMENT

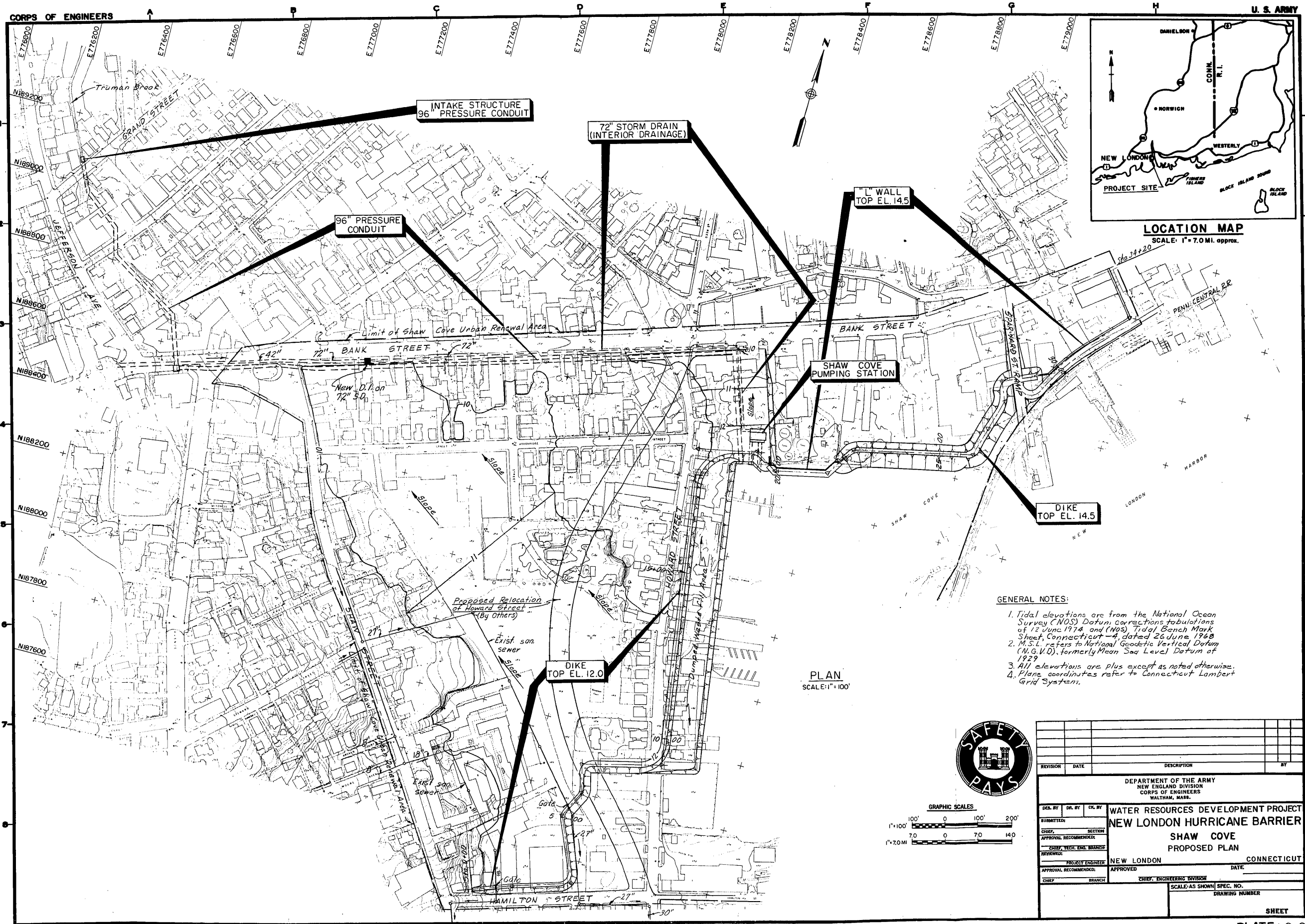
58. General. The original Final Impact Statement was placed on file with the Council of Environmental Quality on 26 July 1971. A revised draft of the EIS was placed on file with CEQ on 30 July 1975 and a Final Impact Statement was filed with CEQ on 25 August 1976.

59. Views of Consultants. No consultants were used in the preparation of this Design Memorandum. A report prepared by an Architect-Engineering firm for the City of New London on the pressure conduit is included in Appendix C of this report.

V. RECOMMENDATIONS

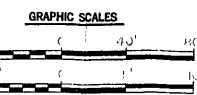
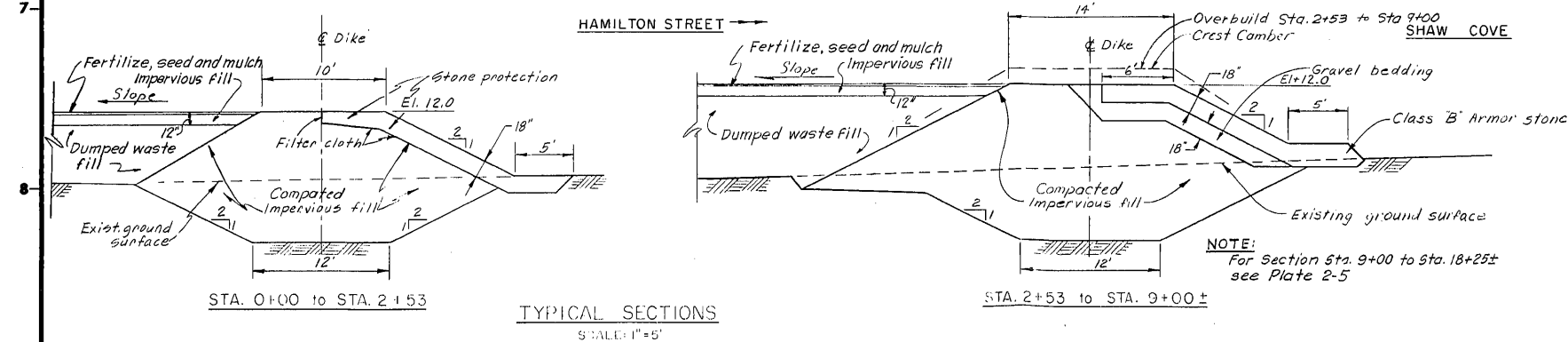
60. Recommendation. It is recommended that the project plan submitted in this memorandum be approved as the basis for the preparation of contract plans for the New London Hurricane Protection Project.







- NOTES:
1. For continuation of Fill Area, see Plate 2-2
 2. See Typical Sections for Sta. 9+00 to Sta. 18+25± on Plate 2-5.



REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

WATER RESOURCES DEVELOPMENT PROJECT

NEW LONDON HURRICANE BARRIER

SHAW COVE

PLAN AND SECTIONS NO. 1

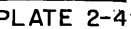
NEW LONDON CONNECTICUT

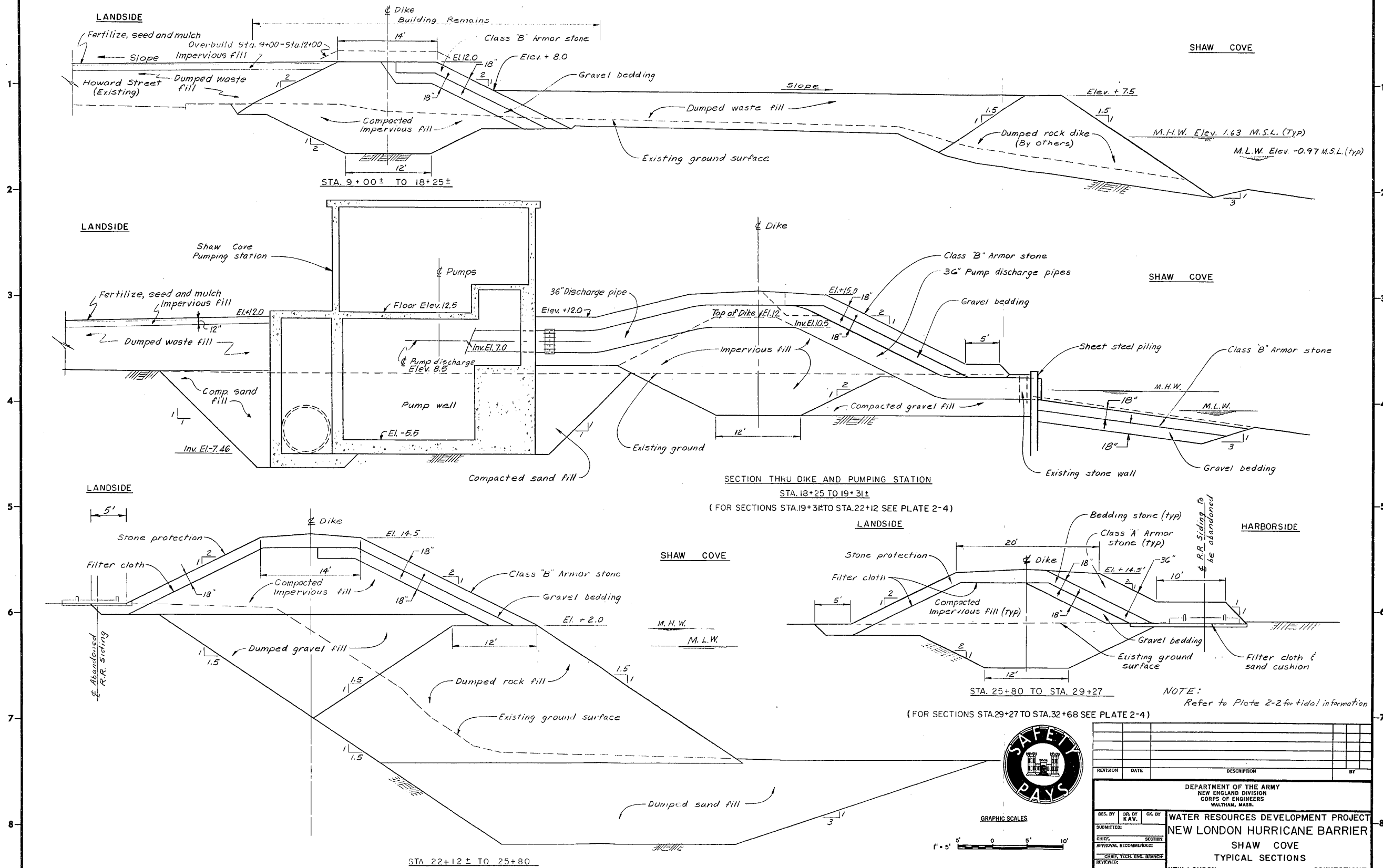
DATE

SCALE AS SHOWN SPEC. NO.

DRAWING NUMBER

SHEET





REVISION	DATE	DESCRIPTION	BY

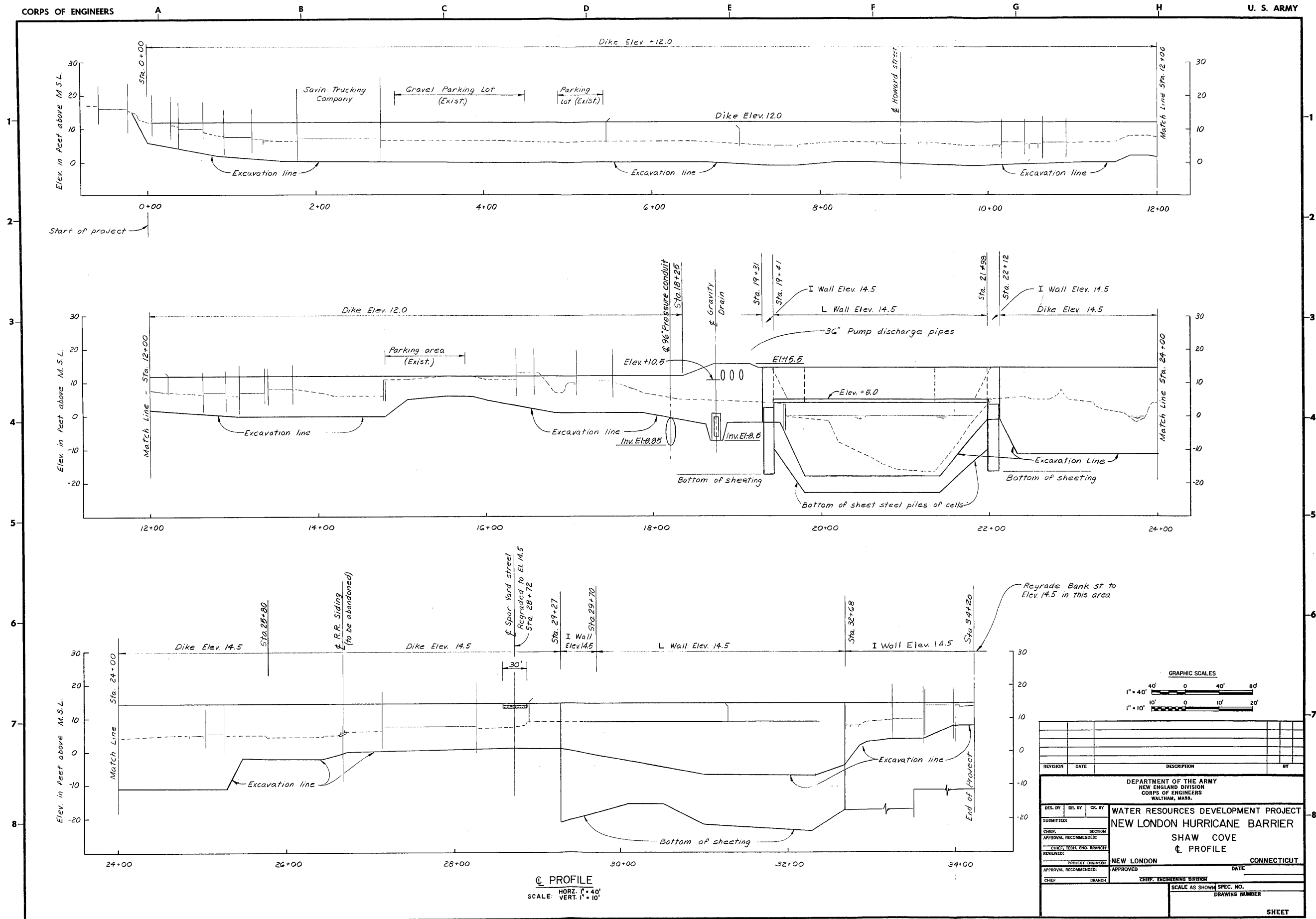
DES. BY		DR. BY	CK. BY
SUBMITTED:			
CHIEF	SECTION		
APPROVAL RECOMMENDED:			
REVIEWER:	CHIEF, TECH. ENG. BRANCH		
PROJECT ENGINEER			
APPROVAL RECOMMENDED:	APPROVED	DATE	
CHIEF	BRANCH	CHIEF, ENGINEERING DIVISION	
SCALE 1" = 5'		SPEC. NO.	
DRAWING NUMBER			

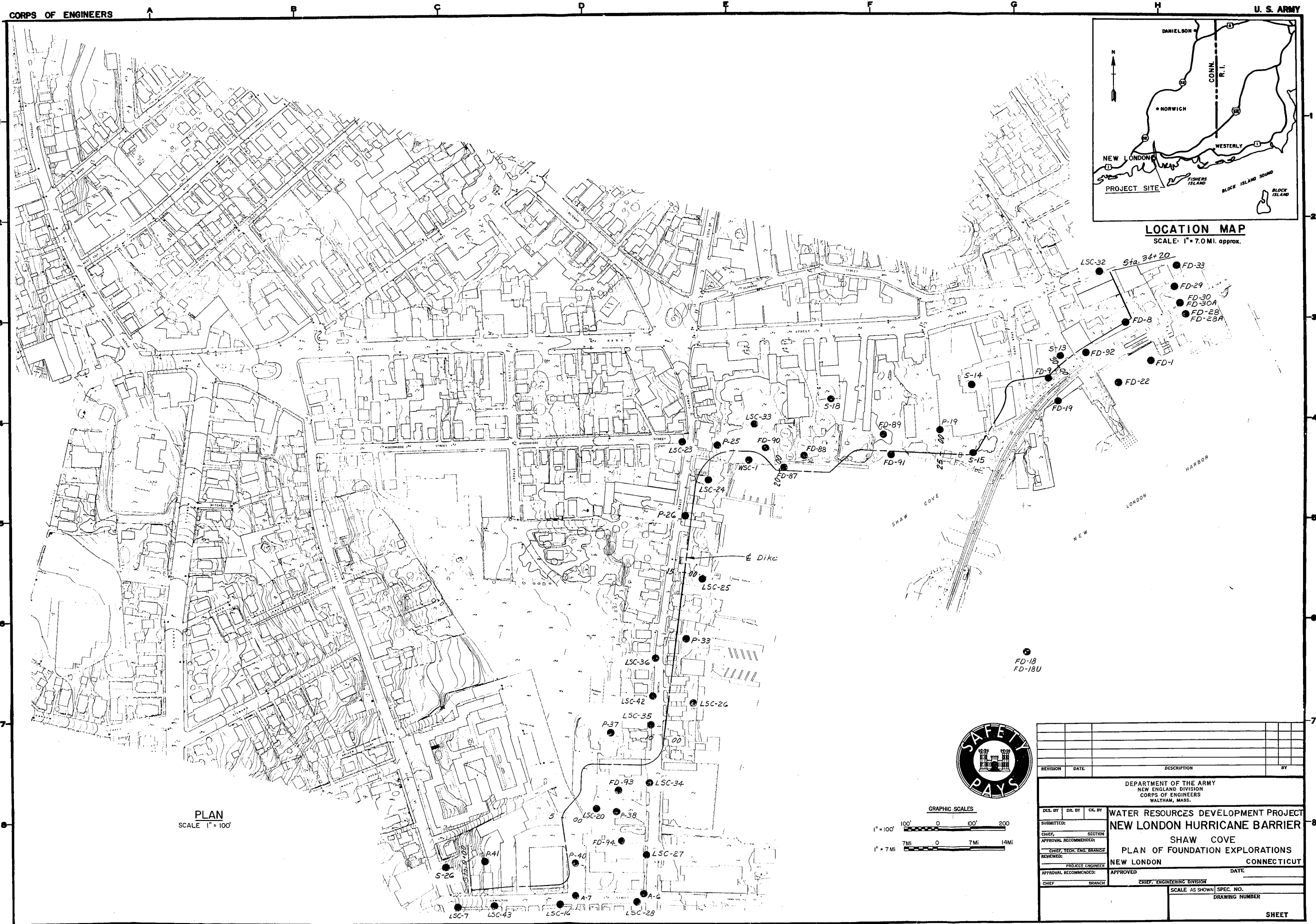
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

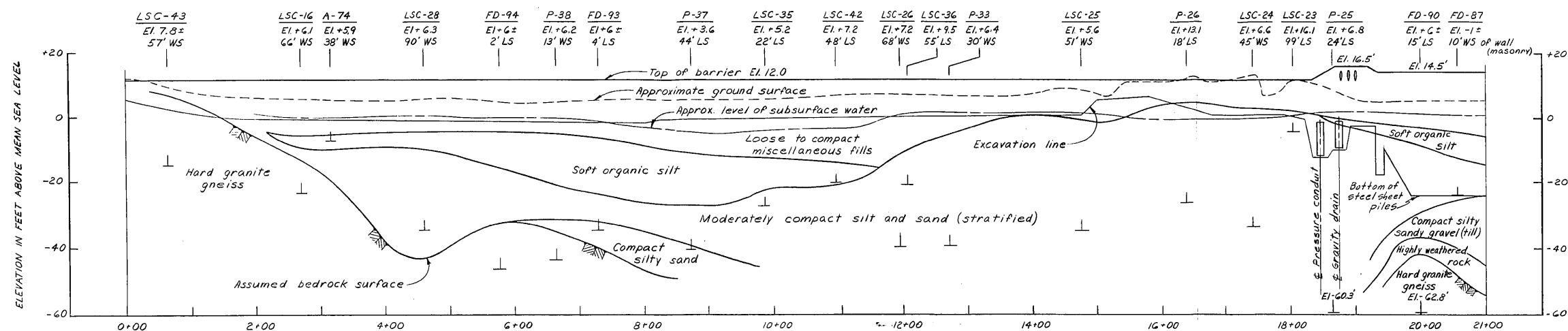
WATER RESOURCES DEVELOPMENT PROJECT
NEW LONDON HURRICANE BARRIER
SHAW COVE
TYPICAL SECTIONS

NEW LONDON CONNECTICUT

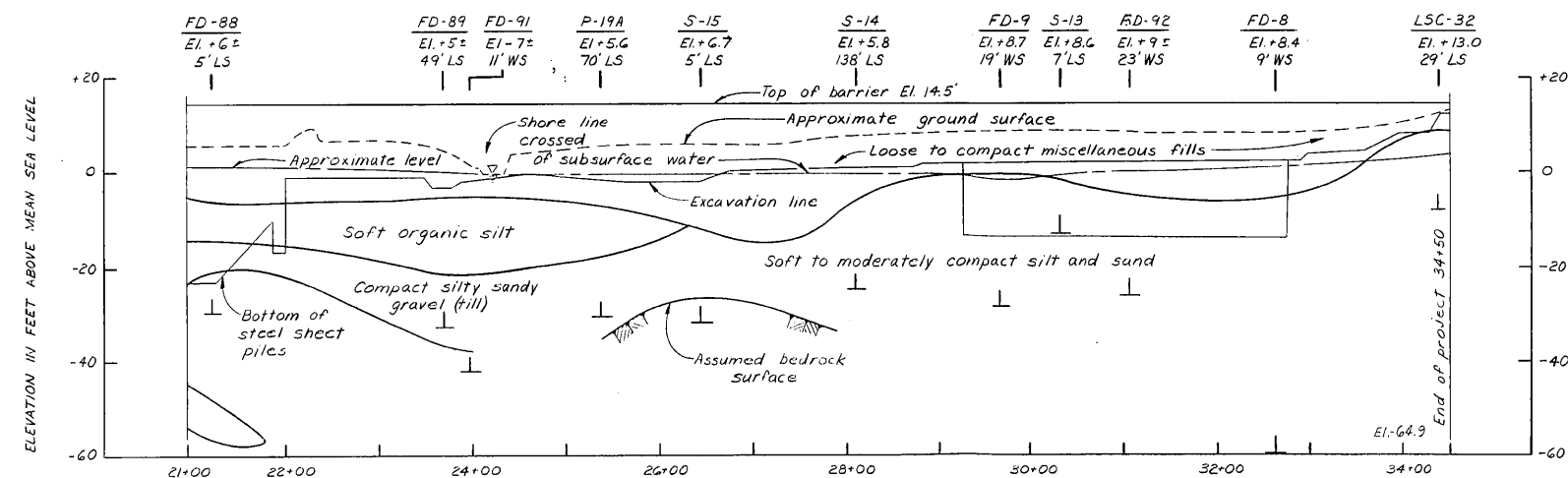
SHEET





PROFILE ALONG $\frac{1}{2}$ OF STRUCTURES

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PROFILE (CONT.)

NOT TO SCALE

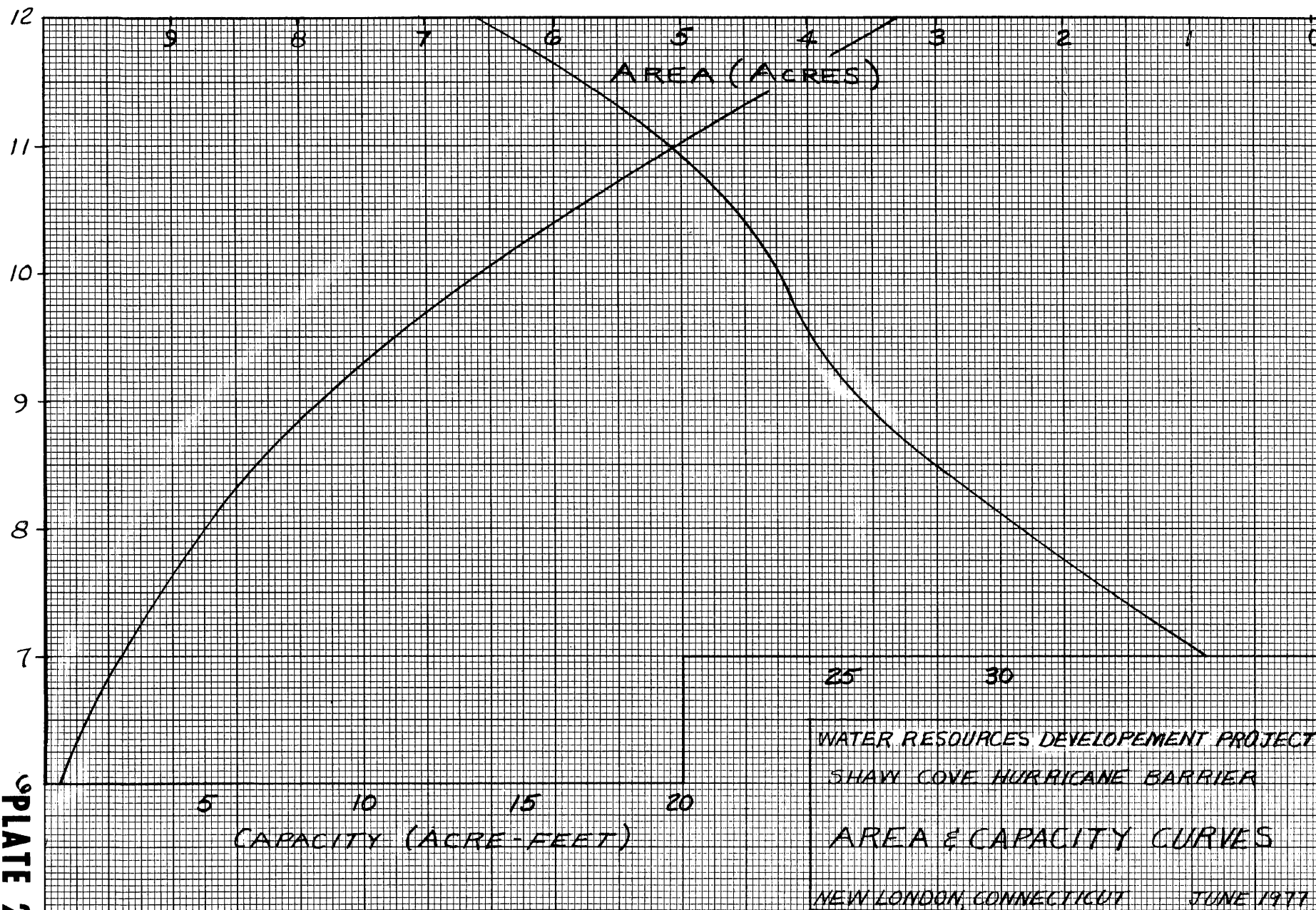


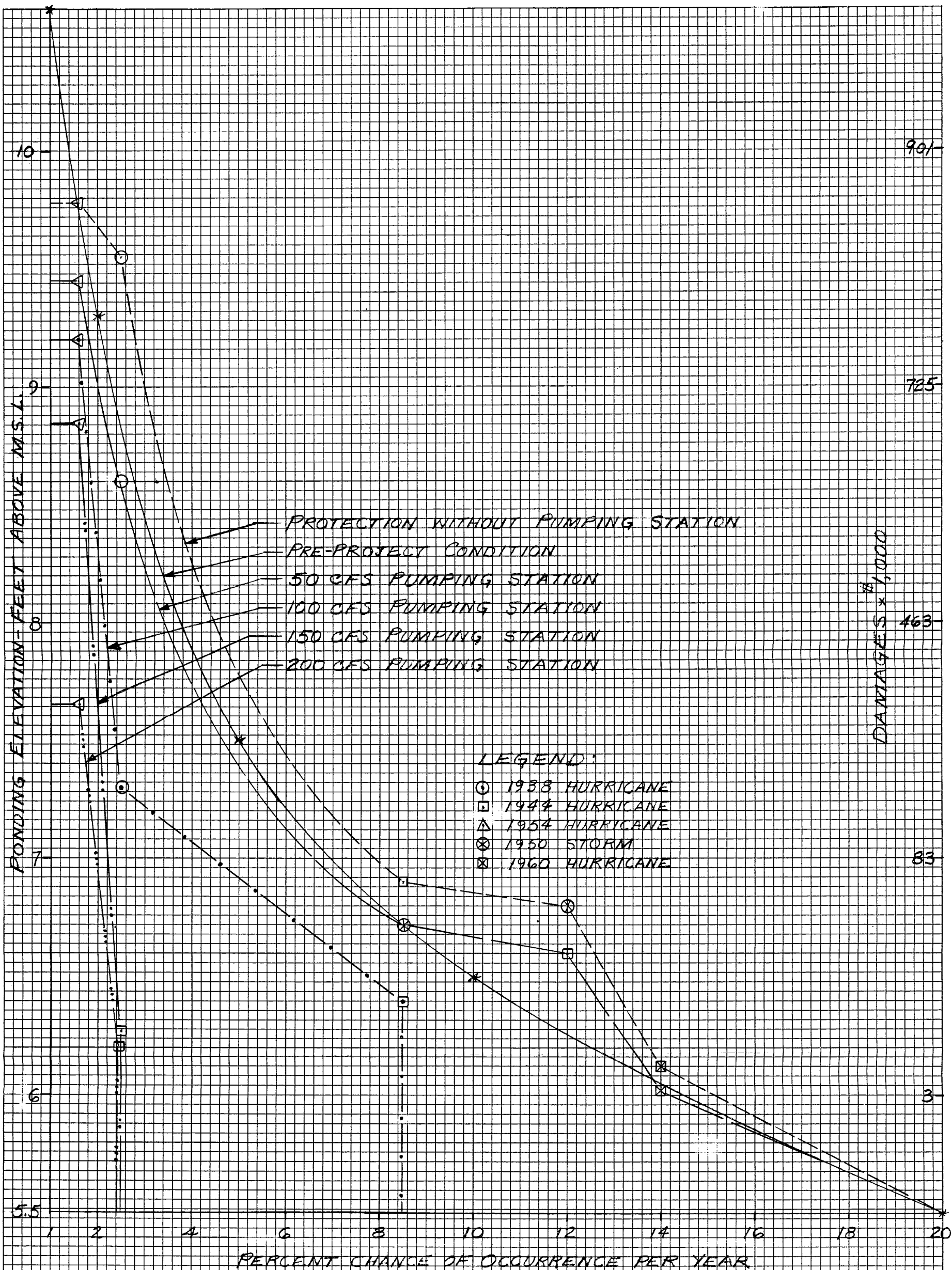
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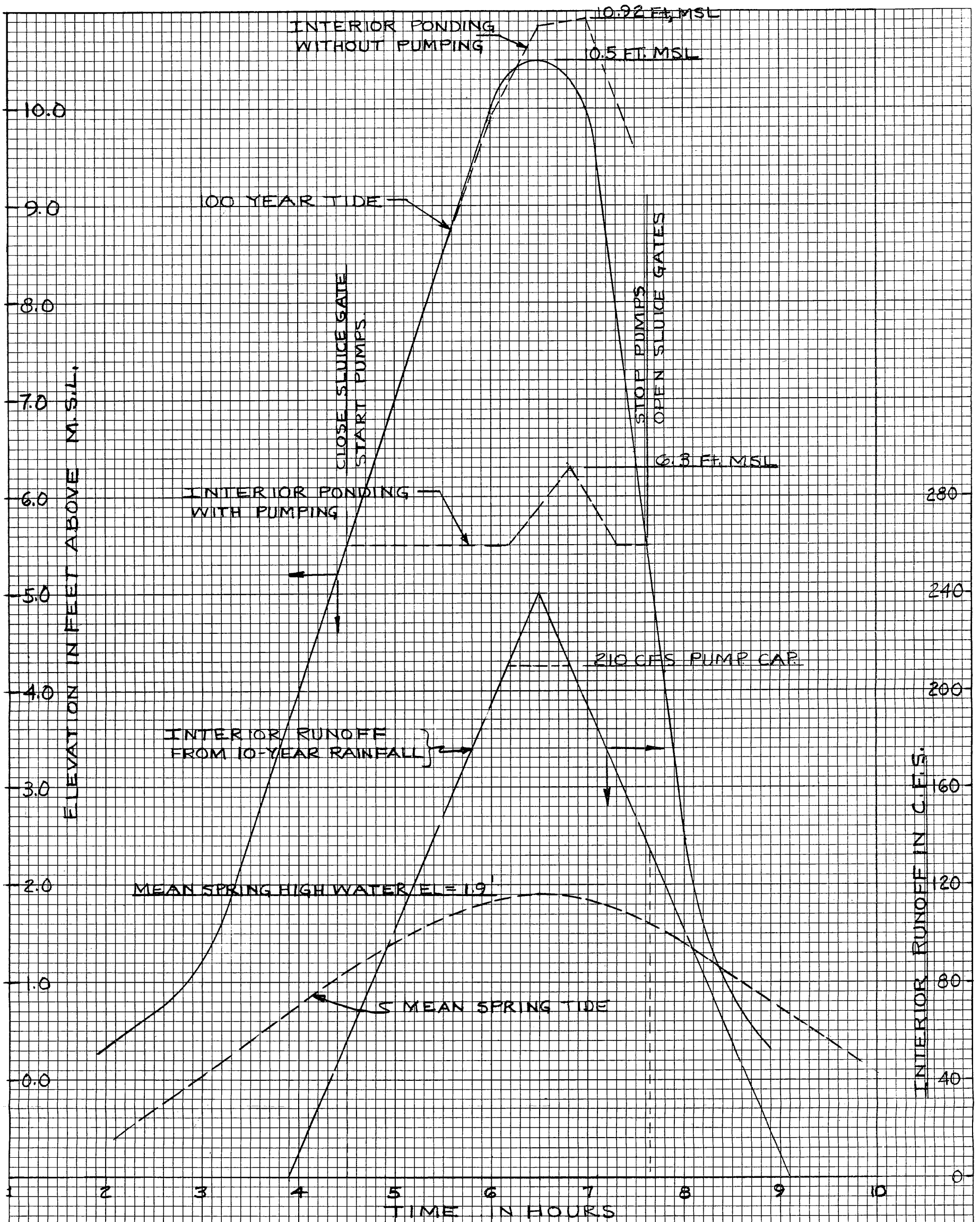
DES. BY			DR. BY	CK. BY
SUBMITTED:				
CHIEF:			SECTION	
APPROVAL RECOMMENDATION:			CHIEF, TECH. ENG. BRANCH	
REVIEWED:			PROJECT ENGINEER	
APPROVAL RECOMMENDATION:			APPROVED	DATE
CHIEF:			BRANCH	CHIEF, ENGINEERING DIVISION
			SCALE	SPEC. NO.
			DRAWING NUMBER	
			SHEET	

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

WATER RESOURCES DEVELOPMENT PROJECT
NEW LONDON HURRICANE BARRIER
SHAW COVE
GEOLOGIC PROFILE
NEW LONDON CONNECTICUT

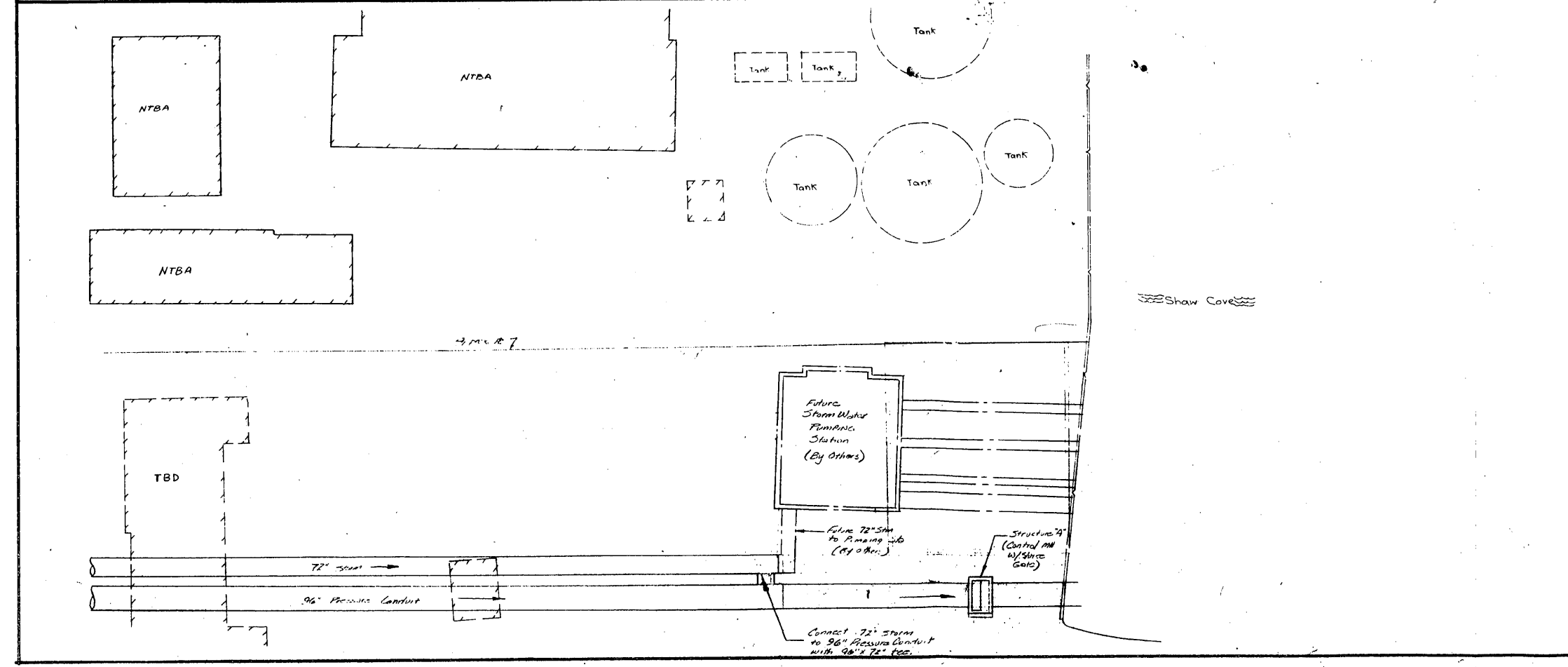
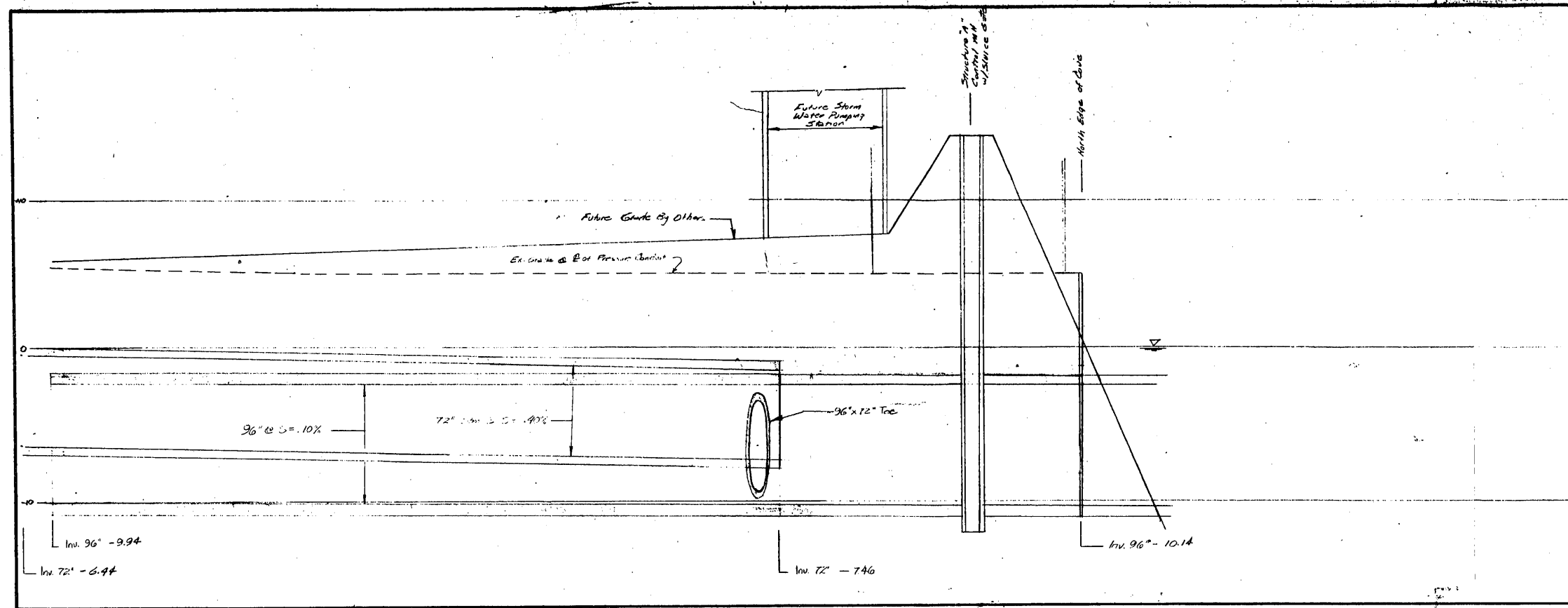


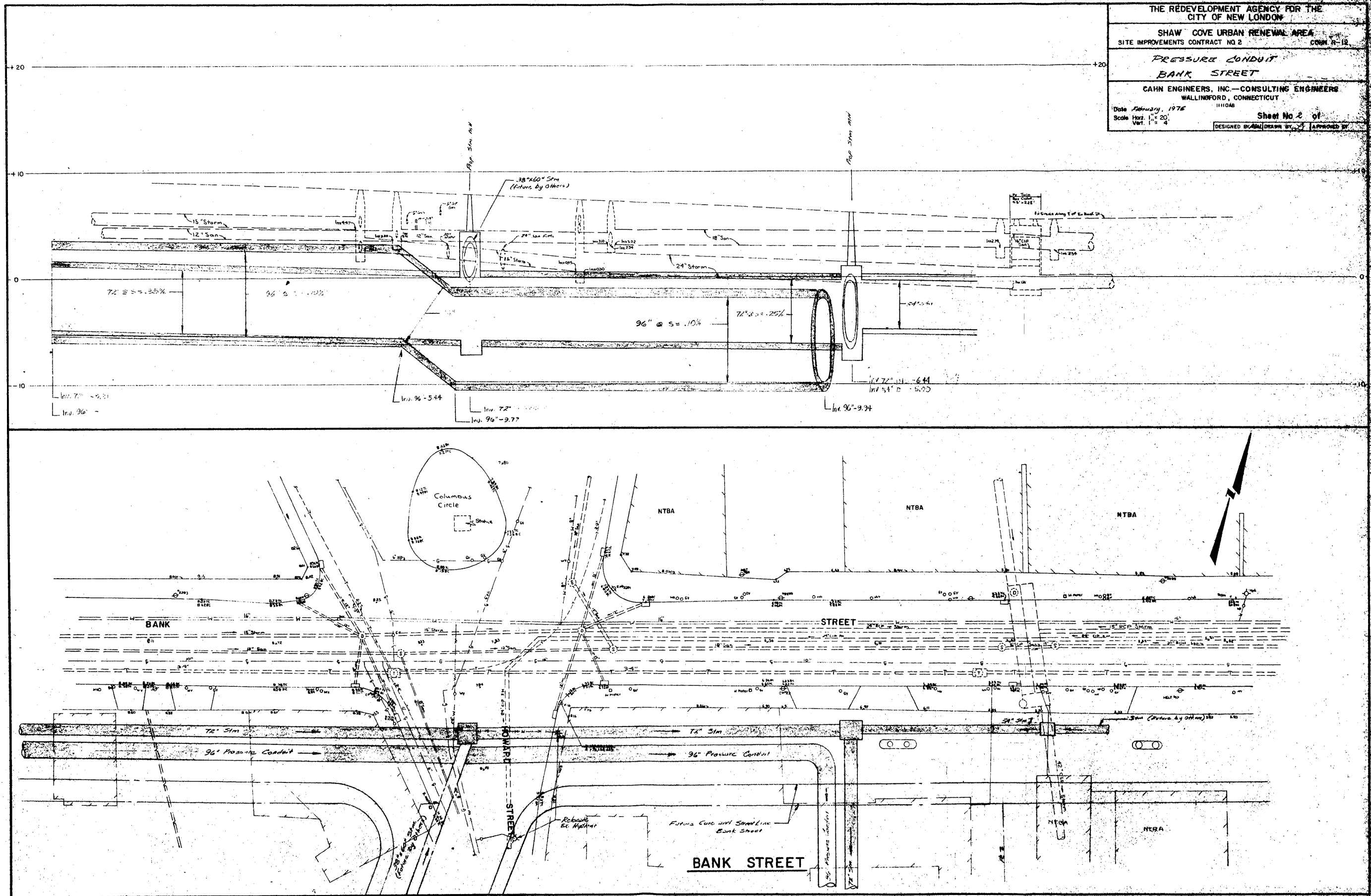




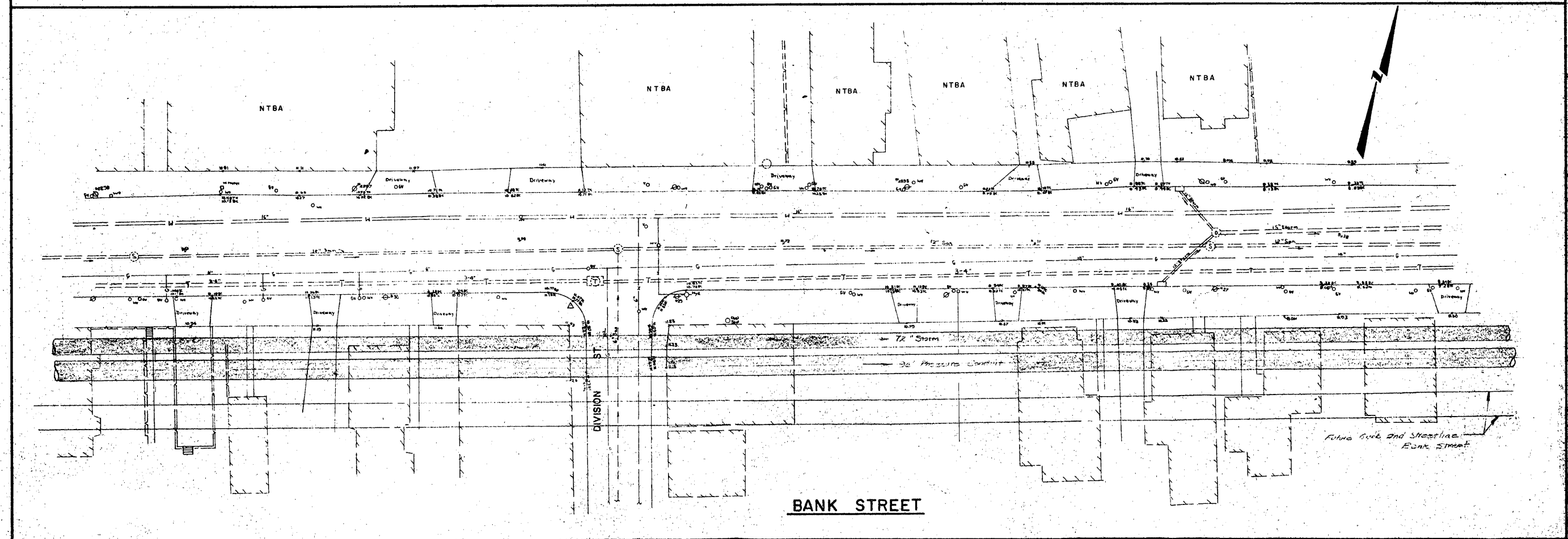
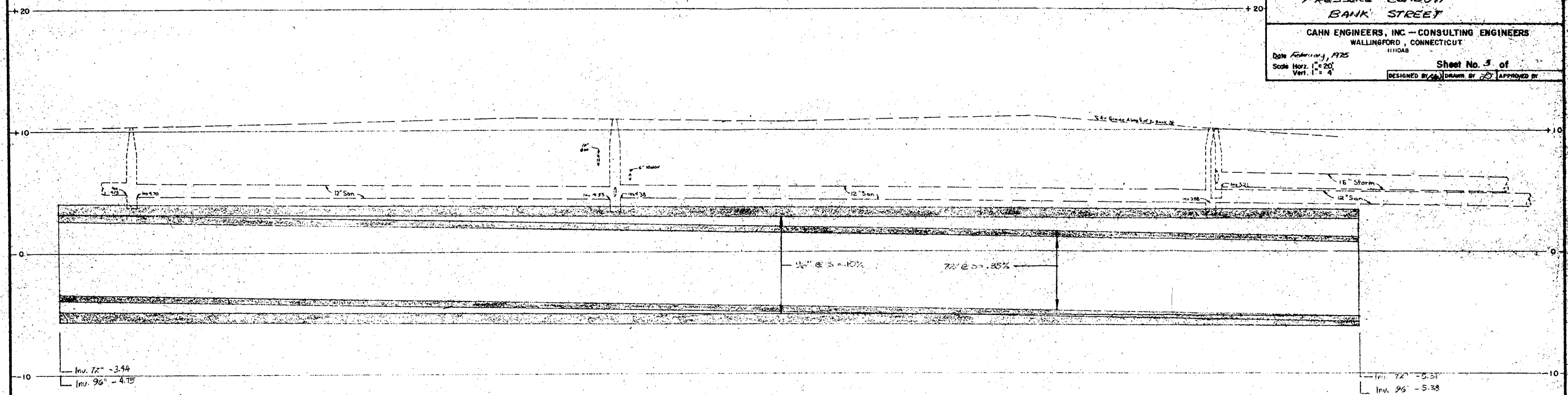
WATER RESOURCES DEVELOPMENT PROJECT
 SHAW COVE HURRICANE BARRIER
 EFFECT OF SELECTED PUMPING
 STATION CAPACITY
 NEW LONDON, CONNECTICUT JUNE 1977

THE REDEVELOPMENT AGENCY FOR THE CITY OF NEW LONDON	
SHAW COVE URBAN RENEWAL AREA	
SITE IMPROVEMENTS CONTRACT NO. 2	CONTRACT R-126
PRESSURE CONDUIT OULET TO SHAW COVE	
CANN ENGINEERS, INC. - CONSULTING ENGINEERS WALLINGFORD, CONNECTICUT	
Date FEBRUARY 1975	Sheet No. 1 of 1
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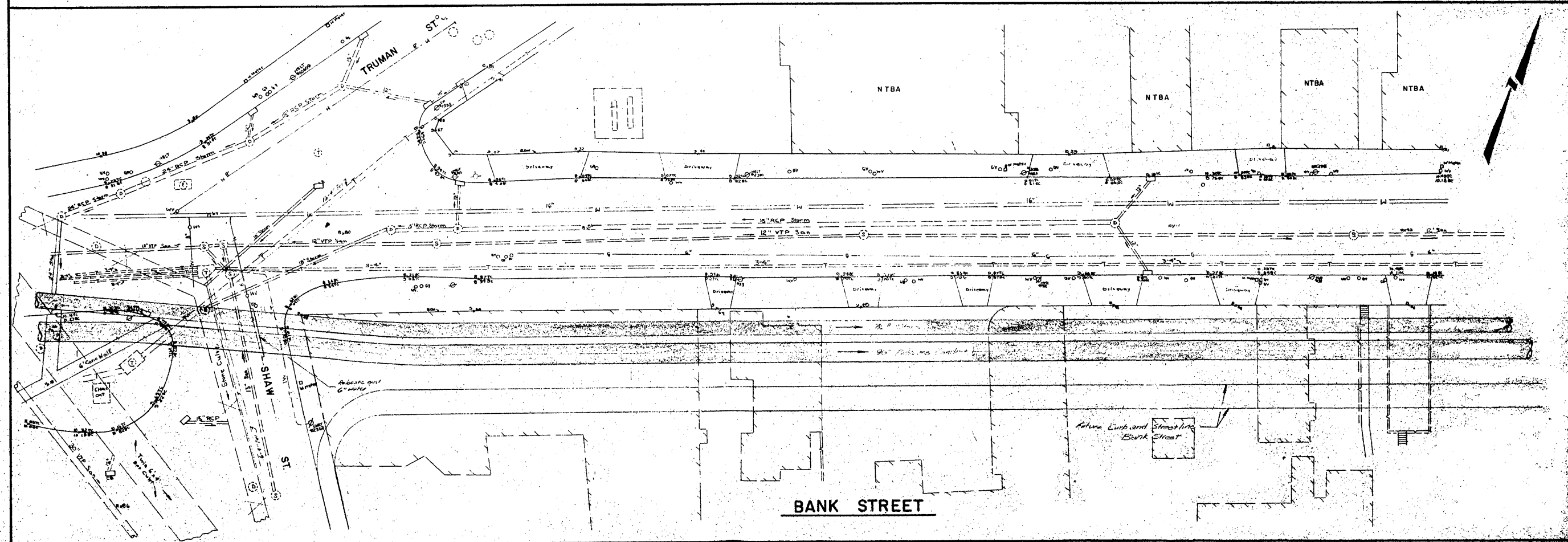
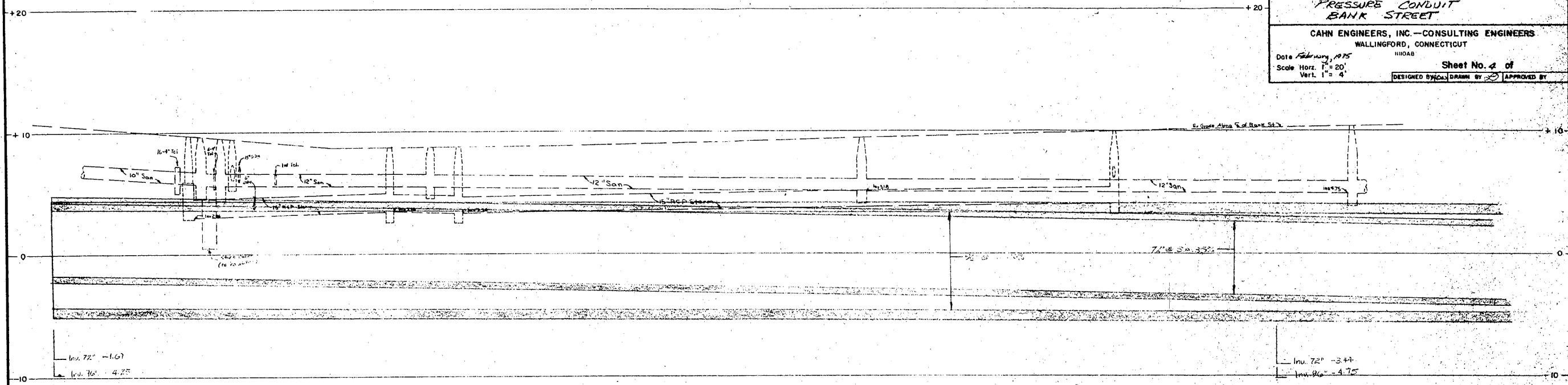




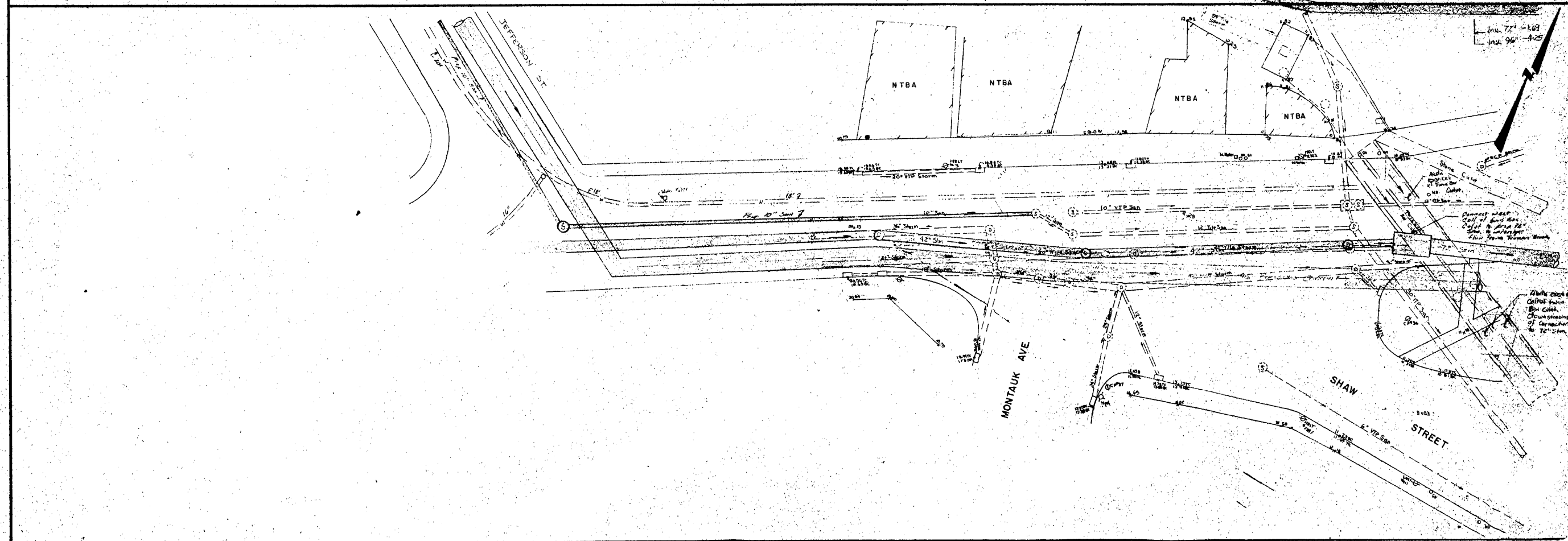
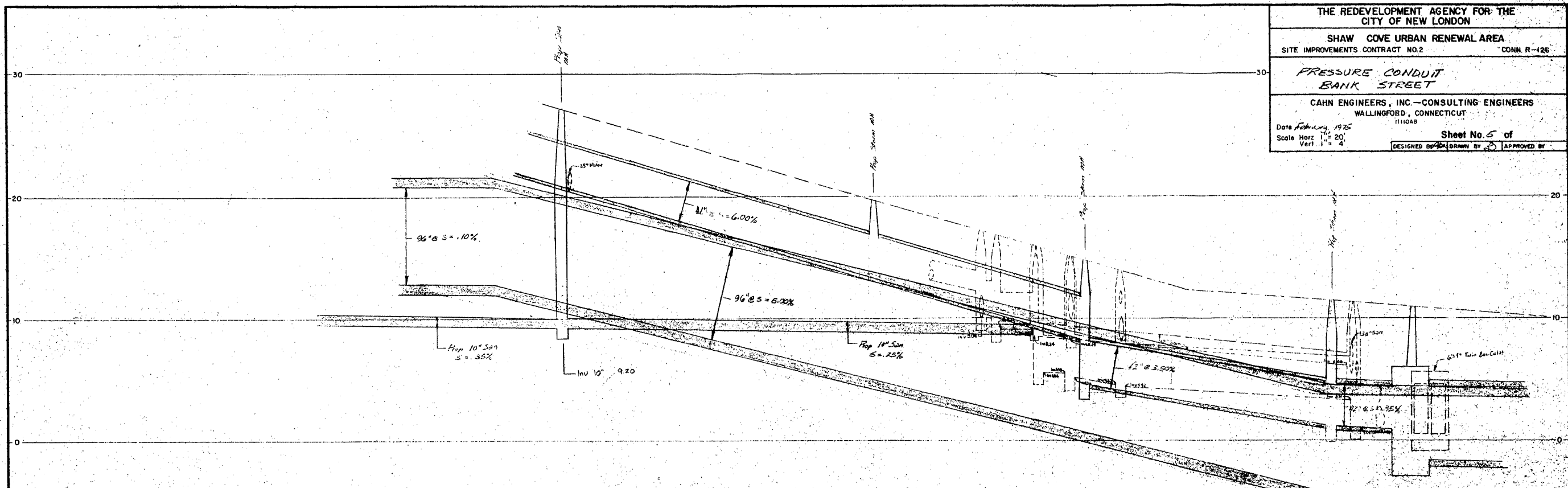
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SHAW COVE URBAN RENEWAL AREA	
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PRESSURE CONDUIT BANK STREET	
CAHN ENGINEERS, INC. - CONSULTING ENGINEERS WALLINGFORD, CONNECTICUT 06108	
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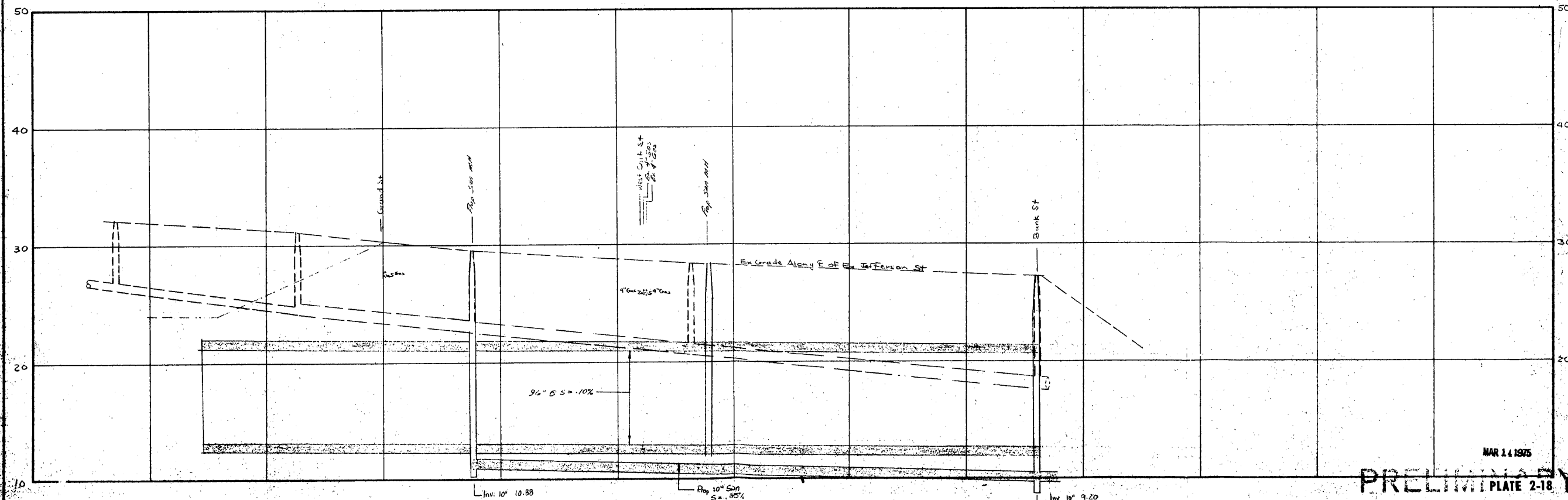
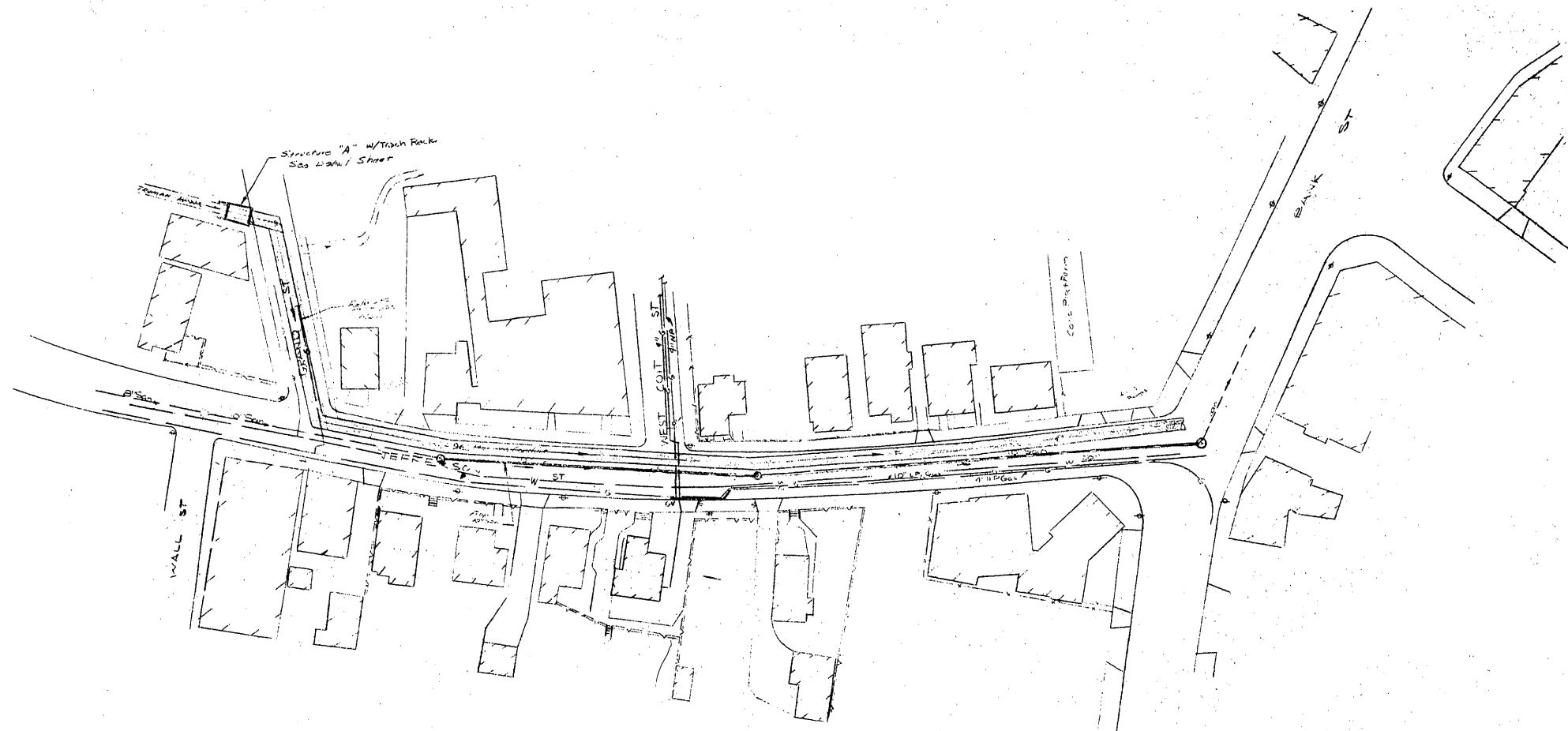
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SHAW COVE URBAN RENEWAL AREA	
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PRESSURE CONDUIT BANK STREET	
CAHN ENGINEERS, INC. - CONSULTING ENGINEERS WALLINGFORD, CONNECTICUT	
Date February, 1975 Scale Horiz. 1" = 20' Vert. 1" = 4'	Sheet No. 4 of DESIGNED BY [Signature] DRAWN BY [Signature] APPROVED BY [Signature]



THE REDEVELOPMENT AGENCY FOR THE CITY OF NEW LONDON	
SHAW COVE URBAN RENEWAL AREA	
SITE IMPROVEMENTS CONTRACT NO.2	CONN. R-125
PRESSURE CONDUIT BANK STREET	
CAHN ENGINEERS, INC.—CONSULTING ENGINEERS WALLINGFORD, CONNECTICUT 11104B	
Date February, 1975 Scale Horiz. 1" = 20' Vert. 1" = 4'	Sheet No. 5 of
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APPROVED BY	



THE REDEVELOPMENT AGENCY FOR THE CITY OF NEW LONDON	
SHAW COVE URBAN RENEWAL AREA	
SITE IMPROVEMENTS CONTRACT NO.2	CONN. R-126
PRESSURE CONDUIT JEFFERSON ST	
CAHN ENGINEERS, INC.—CONSULTING ENGINEERS WALLINGFORD, CONNECTICUT	
Date: February, 1975 Scale: H=2"=100' V=4"=10'	Sheet No. 6 of 6 DESIGNED BY: [Signature] DRAWN BY: [Signature] APPROVED BY: [Signature]



MAR 14 1975
PRELIMINARY
PLATE 2-18

GENERAL NOTES - STRUCTURE "A"

-
- Technical drawings of a bridge structure, including a plan view, a side elevation, and a cross-section.
- Plan View:**
- Dimensions: 12'-0" (width), 17'-0" (length).
 - Materials: 6" C.P. (concrete pipe), 6" Perf. C.M.P. (perforated concrete masonry pipe), 6" Aluminum Chain Link Fence with top and bottom rail.
 - Annotations: "4" OD Hot-Dipped Galv steel pipe sleeve, 2'-6" long. Fill around fence with non-shrink grout. Typ. sec. as noted.", "6" C.P. as shown, both sides", "Flow", "Truman Brook", "Ex. Masonry Wall to remain", "Riprap and bedding material to conform to standard specifications. All costs included in price bid for Structure 'A'".
- Side Elevation:**
- Dimensions: 12'-0" (width), 10'-0" (height).
 - Materials: 6" C.P., 6" Perf. C.M.P., 6" Stone, 4'-0" (height), 6" Mils. (material).
 - Annotations: "12'-0" of ex. wall to match proposed wall! Cost included in bid price for Structure 'A'", "Manhole Steps", "Undisturbed Soil", "Reinforcement symmetrical about C".
- Cross-Section:**
- Dimensions: 12'-0" (width), 10'-0" (height).
 - Materials: 6" C.P., 6" Perf. C.M.P., 6" Stone, 4'-0" (height), 6" Mils. (material).
 - Annotations: "Flow", "Truman Brook", "Ex. Masonry Wall to remain", "Riprap and bedding material to conform to standard specifications. All costs included in price bid for Structure 'A'".

SECTION "C-C"

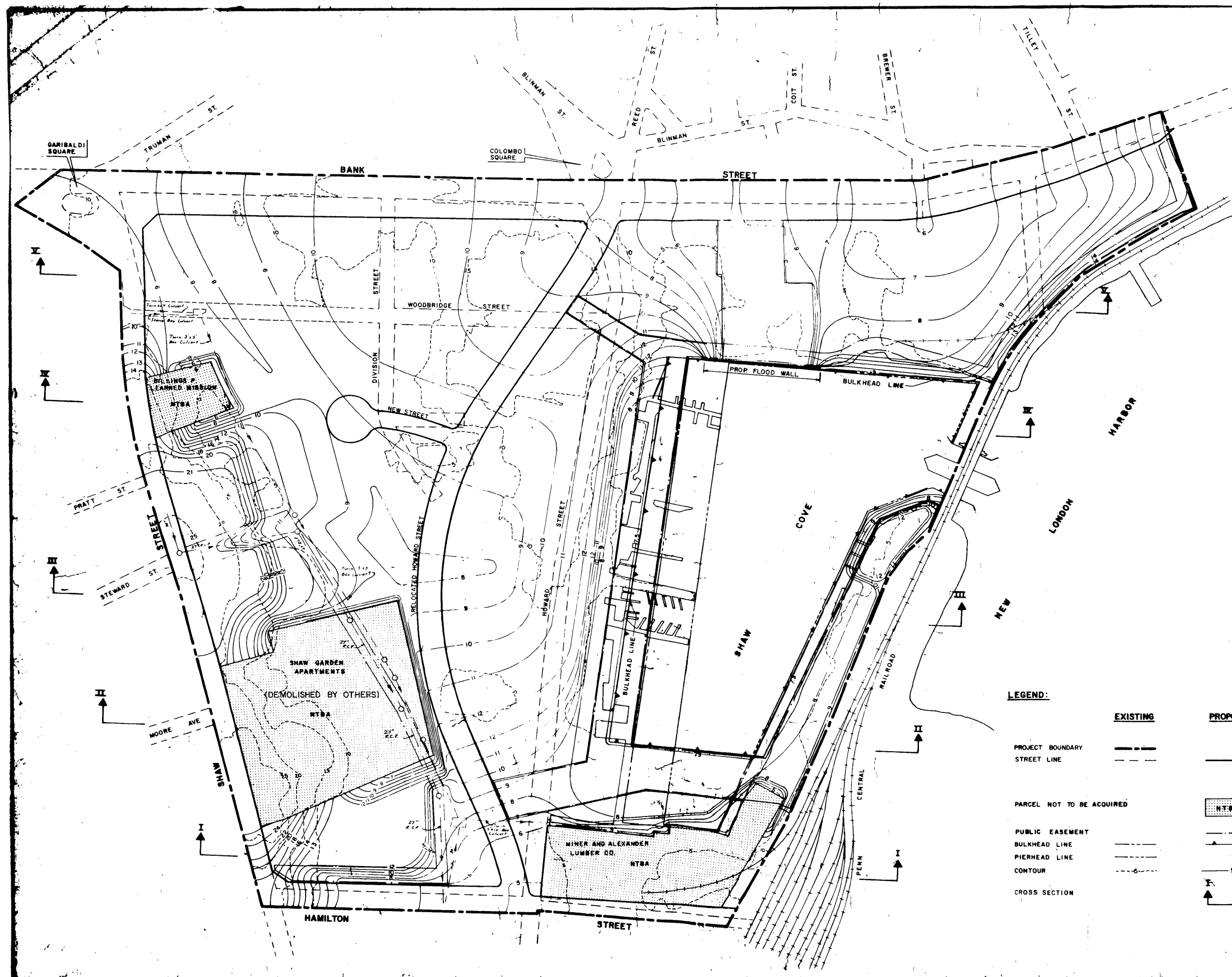
N. T. S.

Note: All reinforcement shown is #5 @ 12" unless otherwise shown.

SITE GRADING

Date: July 1974
Scale: AS NOTED
DESIGNED BY: [Signature] DRAWN BY: [Signature] APPROVED BY: [Signature]

200 0 100 200



LEGEND:

	EXISTING	PROPOSED
PROJECT BOUNDARY	---	---
STREET LINE	---	---
PARCEL NOT TO BE ACQUIRED		NTBA
PUBLIC EASEMENT	---	---
BULKHEAD LINE	---	---
PIERHEAD LINE	---	---
CONTOUR	---	---
CROSS SECTION		

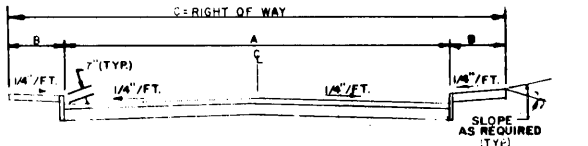
(Proposed Final Grade - Surcharge Elev. Not Shown)

Note for Section View see Sheet 2-21

STREET IMPROVEMENTS & TRAFFIC PLAN

Date July 1974
Scale: AS NOTED
DESIGNED BY: *MM* DRAWN BY: *MM* APPROVED BY: *MM*
Sheet No. 2 of 7

0 100 200



STREET	A (ft)	B (ft)	C (ft)
HOWARD STREET	48	6	60
SHAW STREET	40	5	50
HAMILTON STREET	40	5	50
BANK STREET*	86	10	106
NEW STREET	36	5	50

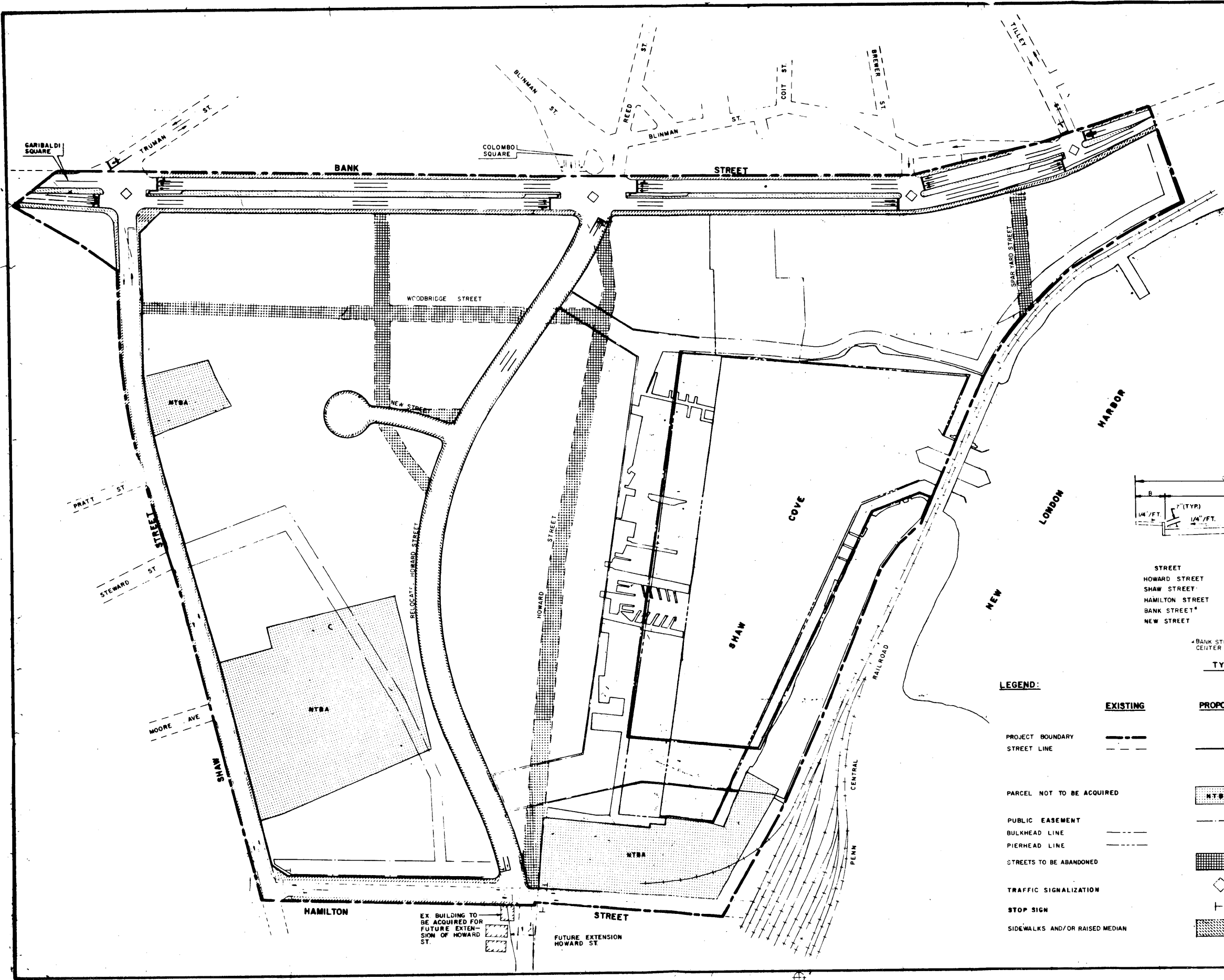
*BANK STREET WILL BE DOUBLE CROWNED WITH A RAISED CENTER MEDIAN VARYING IN WIDTH FROM 4' TO 14'.

TYPICAL SECTIONS

NTS

LEGEND:

	EXISTING	PROPOSED
PROJECT BOUNDARY	---	---
STREET LINE	---	---
PARCEL NOT TO BE ACQUIRED		NTBA
PUBLIC EASEMENT		---
BULKHEAD LINE	---	---
PIERHEAD LINE	---	---
STREETS TO BE ABANDONED		Grid Pattern
TRAFFIC SIGNALIZATION		Diamond
STOP SIGN		T
SIDEWALKS AND/OR RAISED MEDIAN		Grid Pattern



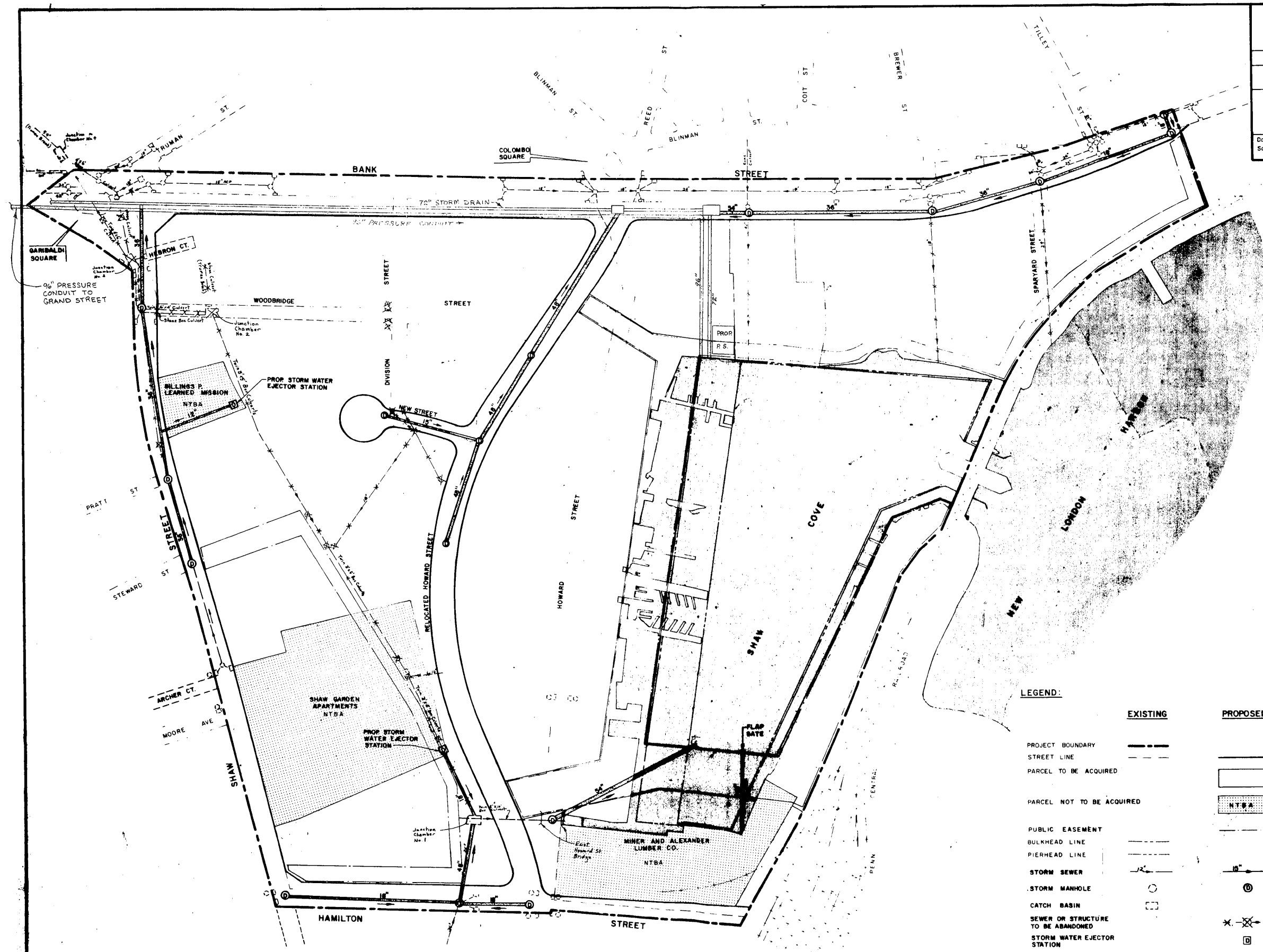
STORM DRAINS

Date: July 1974
Scale: AS NOTED

Sheet No. 3 of 7

DESIGNED BY: [Signature] DRAWN BY: [Signature] APPROVED BY: [Signature]

200 0 100 200



LEGEND:

	EXISTING	PROPOSED
PROJECT BOUNDARY	---	---
STREET LINE	---	---
PARCEL TO BE ACQUIRED		[Box]
PARCEL NOT TO BE ACQUIRED		[Box] NTBA
PUBLIC EASEMENT	---	---
BULKHEAD LINE	---	---
PIERHEAD LINE	---	---
STORM SEWER	---	---
STORM MANHOLE	○	⊙
CATCH BASIN	□	□
SEWER OR STRUCTURE TO BE ABANDONED	---	---
STORM WATER EJECTOR STATION		⊞

APPENDIX A

LETTERS OF COMMENT & CONCURRENCE

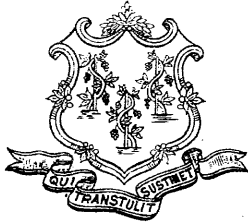
APPENDIX A

LETTERS OF COMMENT & CONCURRENCE

NEW LONDON HURRICANE BARRIER

<u>Letter Dated</u>	<u>Contents</u>	<u>Exhibit</u>
Feb 28, 1975	Governor of Connecticut	1
Feb 18, 1975	Executive Director New London Redevelopment Agency	2
May 19, 1975	City of New London	3
11 Mar 75	U.S. Dept. of Interior National Park Service Historic Preservation	4 5
26 Mar 75	U.S. Dept. of Interior Fish & Wildlife Service	6
24 Feb 75	New England Regional Commission	7
6 Mar 75	U.S. Dept. of Interior Bureau of Outdoor Recreation	8
4 Mar 75	U.S. Dept. of Commerce National Oceanic and Atmospheric Administration	9
Feb 24, 1975	State of Connecticut Dept. of Transportation	10
Feb 25, 1975	U.S. Dept. of Transportation Federal Highway Administration	11
Feb 20, 1975	State of Connecticut State Department of Health	12
Mar 13, 1975	New England River Basin Commission	13
Feb 21, 1975	Dept. of Transportation	14
Mar 3, 1975	U.S. Coast Guard	15

ELLA GRASSO
GOVERNOR



STATE OF CONNECTICUT
EXECUTIVE CHAMBERS
HARTFORD

February 28, 1975

Mr. John M. Mason, Colonel
Corps of Engineers
Division Engineer
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Mason:

Thank you for your letter concerning the proposed
New London Hurricane Barrier.

I appreciate your courtesy and your efforts to keep
us informed.

With best wishes,

Cordially,

A handwritten signature in cursive script that reads "Ella Grasso".

ELLA GRASSO
Governor

**NEW
LONDON
CONNECTICUT
REDEVELOPMENT
AGENCY**



JEROME SILVERSTEIN, *Chairman*
B. NORTON ROSSITER
SEYMOUR S. HENDEL
EDWARD N. PERRY
ERNEST F. KYDD, JR.

→ ROBERT P. TURK, *Executive Director*

31 UNION STREET • NEW LONDON, CONNECTICUT 06320 • PHONE: 442-4337

February 18, 1975

John Wm. Leslie
Chief, Engineering Division
Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

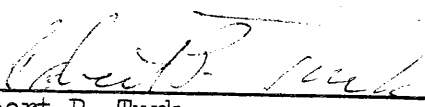
Re: NEDED-E
New London Hurricane Barrier Project
Shaw's Cove Urban Renewal
Project CONN. R-126

Dear Mr. Leslie:

We have reviewed Inclosure No. 2, submitted February 10, 1975, with our consultants, Cahn Engineers, and find it in essential conformance with our previous understandings.

When final design commences, however, we would like to be involved as there are some minor concerns that we would like to resolve.

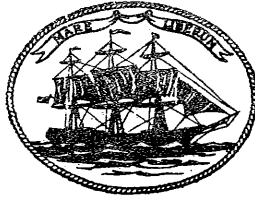
Sincerely,



Robert P. Turk
Executive Director

cc: C. Francis Driscoll, City Manager
John A. Hofmann, Cahn Engineers

EXHIBIT 2



CITY OF NEW LONDON
CONNECTICUT

May 19, 1975

Mr. John Leslie, Chief Engineering Division
Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

RE: NEW LONDON HURRICANE BARRIER PROJECT
NEDED-E

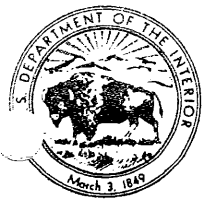
Dear Mr. Leslie,

The City's position concerning the New London Hurricane Barrier Project remains as stated in my February 23, 1972 letter to you. The revised project is to protect the Shaw's Cove Urban Renewal Project against hurricane tidal flooding. The project revision consists of deleting the Bentley Creek protection barrier from the authorized project and modifying the Shaw's Cove barrier to a land based protection scheme. The degree of flood protection is to be at the 100 year storm frequency level.

The Shaw's Cove Urban Renewal Project is now in execution, completing 55% of its land acquisition activities and anticipating the commencement of site improvement activities during the coming summer months. The City anticipates that the Corp will continue to work with the Redevelopment Agency to insure the compatibility of the flood protection project with the renewal project and that the flood protection project will be conducted as expeditiously as possible.

Sincerely yours,

C. Francis Driscoll
City Manager



United States Department of the Interior

NATIONAL PARK SERVICE
WASHINGTON, D.C. 20240

IN REPLY REFER TO:

H34-PR

MAR 11 1975

Mr. John Wm. Leslie
Chief, Engineering Division
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02151

Dear Mr. Leslie:

Thank you for your letter of February 10, 1975, to Dr. Connally, requesting information concerning sites that might be affected by the New London Hurricane Barrier Project, New London, Connecticut.

Enclosed is a list of sites and their locations in New London that are presently included in the National Register of Historic Places. As this is not a complete listing of the historical and archeological resources in the proposed project area, you should contact the State Historic Preservation Officer concerning additional sites that might be included in the State inventory. You should also keep in mind that a professional quality survey should be completed to identify all the resources in the area and determinations of eligibility for listing in the National Register should be sought for those that might qualify pursuant to Executive Order 11593 and Section 800.4(a)(2) of the procedures of the Advisory Council on Historic Preservation (36 CFR 800).

Enclosed is a copy of instructions for obtaining such determinations. If we can be of assistance with these or any other matters, please do not hesitate to contact us.

We appreciate your cooperation on behalf of historic preservation.

Sincerely yours,

A. R. Mortensen
Director, Office of Archeology
and Historic Preservation

Enclosures

CONSERVE
AMERICA'S
ENERGY



Save Energy and You Serve America!

EXHIBIT 4



United States Department of the Interior

NATIONAL PARK SERVICE

NORTH ATLANTIC REGION
150 CAUSEWAY STREET
BOSTON, MA. 02114

IN REPLY REFER TO:

L-7619-NAR-(CE)
(Hurricane Barrier
New London, CT)

March 17, 1975

Mr. John Wm. Leslie, Chief
Engineering Division
Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Leslie:

This is in response to your letter of 10 February requesting our review and comment on your New London Hurricane Barrier Project, New London, Connecticut.

While the review material (two drawings) enclosed with your letter does not provide sufficient detailed information for us to understand the depth of your environmental evaluations, we can see the geographic location and scope of the project. We would understand that you are preparing a supplement to an environmental impact statement (filed July 26, 1971), and we would fully expect to see our concerns addressed in that supplement. You should understand that our comments herein are presented solely as technical information from the National Park Service to assist you in preparation of the environmental statement supplement and in no way represents an official review position of the Department of the Interior. We would expect a consolidated Departmental review to be accomplished when your environmental statement supplement is filed with the Council on Environmental Quality and circulated for comment.

The proposed project will not adversely affect any existing, proposed or known potential unit of the National Park System, or any known historic, natural, or environmental education sites eligible for the National Landmark Programs.

As required by the Historic Preservation Act of 1966, E.O. 11593 and being of a bonafide part of the human environment scope of the National Environmental Policy Act of 1969 (1970), careful consideration must be given to cultural resources which break into three basic elements; historical, architectural and archeological. Although the National Park Service has extensive expertise in these areas, we do not have complete knowledge



Save Energy and You Serve America!

EXHIBIT 5

of the significance of all sites or ones being considered for nomination to the National Register of Historic Places, nor does the Service maintain a complete inventory of all areas of archeological potential.

Therefore, to assure the Corps of no inadvertent oversights, we suggest that you contact the State Historic Preservation Officer (Mr. John W. Shannahan, Director, Connecticut Historical Commission, 59 South Prospect Street, Hartford, Connecticut 06106) for additional clearance on these cultural resources and to contact, Dr. Douglas F. Jordan, University of Connecticut, State Archeological Museum, Storres, Connecticut 06268, for qualified professional advice on the potential of archeological values in the project area and appropriate protective steps to be taken should any such values exist.

As indicated above, we would anticipate official Departmental review of your environmental statement supplement and would expect to find therein an adequate discussion of your considerations for cultural resources, an evaluation of your project upon the resources and what measures of mitigation would be taken for protection of such resources.

We appreciate this opportunity to input to the interagency coordination phase of your planning/decision process.

Sincerely yours,

A handwritten signature in dark ink, appearing to read "David A. Richie". The signature is fluid and cursive, with the first name "David" being more prominent.

David A. Richie
Acting Regional Director



UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Post Office and Courthouse Building
BOSTON, MASSACHUSETTS 02109

MAR 10 1975

Division Engineer
New England Division, Corps of Engineers,
424 Trapelo Road
Waltham, MA 02154

Dear Sir:

Mr. Leslie's letter of February 10, 1975, requested our comments on your revised plan for the New London Hurricane Barrier Project, New London, New London County, Connecticut. This special report supersedes our report of February 17, 1966, and is submitted in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). It has been coordinated with the Connecticut Department of Environmental Protection and the National Marine Fisheries Service.

Your original project involved separate barriers for the Bentleys Creek and Shaw Cove area, consisting of earth-filled dikes and concrete walls. The revised plan calls for the deletion of the Bentleys Creek protection and relocation of the Shaw Cove barrier. Project features call for earth dikes and I-walls around the northwest shores of Shaw Cove, with a street gate, pumping station and pressure conduit.

With the exception of approximately 300 feet of earth dike just inside the entrance to Shaw Cove, all dikes and I-walls will be constructed on the upland. Therefore, we foresee no adverse effects on fish and wildlife resources as a result of the revised project. Should the seaward slope of the 300 feet of dike partially constructed in the water be faced with stone riprap, a modest enhancement of fishery habitat will occur. There would also be a small amount of fishermen utilization of this section of dike, if access is permitted.

Sincerely yours,

ALING Regional Director



EXHIBIT 6

NEW ENGLAND REGIONAL COMMISSION

53 STATE STREET

BOSTON, MASSACHUSETTS 02109

FEDERAL COCHAIRMAN

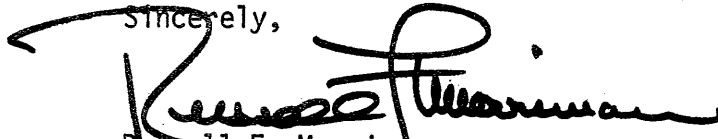
February 24, 1975

Mr. John W. M. Leslie, Chief
Engineering Division
Department of the Army
New England Division, Corp of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Leslie:

Thank you for your letter of February 10, 1975 concerning the reformulating of the New London Hurricane Barrier Project for New London, Connecticut. We have reviewed your letter and the attached material and find that we have no problem with the proposed project. As a matter of fact, since the Commission is concerned with the economic well-being of the region, we find that the proposed project would not only provide employment during the construction phase, but would also protect the New London area. It is therefore consistent with the economic development goals of the New England Regional Commission.

Sincerely,



Russell F. Merriman
Federal Cochairman

WRK/drm

EXHIBIT 7



IN REPLY REFER TO:

United States Department of the Interior

BUREAU OF OUTDOOR RECREATION

NORTHEAST REGIONAL OFFICE

Federal Building - Room 9310

600 ARCH STREET

Philadelphia, Pennsylvania 19106

MAR 6 1975

Mr. John W. Leslie
Chief, Engineering Division
New England Division
U. S. Corps of Engineers
424 Trapelo Road
Waltham, MA 02154

Dear Mr. Leslie:

We are pleased to response to your letter of February 10, 1975, asking for comments on the revised New London Hurricane Barrier Project.

A positive effort should be made to institute non-structural programs for the reduction of flood damage whenever possible. In that light, it would have been most helpful to know the consideration you have given to the non-structural alternatives for this project.

From the information you have made available, this project seems to present an excellent opportunity to relocate the urban renewal out of the flood prone area. This would save the cost of constructing the hurricane barrier and assure against future losses that very well may occur even if it is constructed. If this could be done, it would help reverse the trend of ever increasing flood losses coupled with larger and larger annual expenditures for flood protection.

Although this project proposal is primarily designed to give hurricane protection, if it is constructed, consideration should be given to providing walkways and benches along the earth dike portion of the project.

We thank you for the opportunity to comment on this reformulated project and look forward to further cooperation with your Office.

Sincerely,

JOHN A. HAUPTMAN
Assistant Regional Director
Resource Planning Services

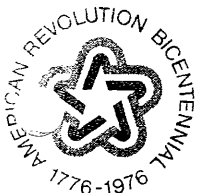


EXHIBIT 8



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Rockville, Md. 20852

Ax2

March 4, 1975

Mr. John W. Leslie
Chief, Engineering Division
Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Attention: NEDED-E

Dear Mr. Leslie:

We have your letter of February 10, 1975, advising of action by your office to reformulate the New London Hurricane Barrier Project, New London, Connecticut. Because of our desire to be as responsive as possible, it is necessary that our reply be jointly prepared by our National Ocean Survey, National Weather Service and Office of Coastal Zone Management. We are proceeding as expeditiously as possible and will forward our comments in the near future.

Sincerely,

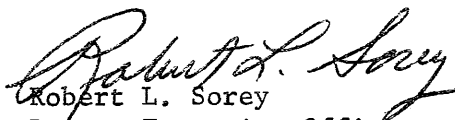
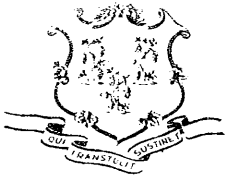

Robert L. Sorey
Deputy Executive Officer

EXHIBIT 9





STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

24 WOLCOTT HILL ROAD, P.O. DRAWER A
WETHERSFIELD, CONNECTICUT 06109



JOSEPH B. BURNS
COMMISSIONER

February 24, 1975

Mr. John Wm. Leslie
Chief, Engineering Division
Department of the Army
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Leslie:

Subject: Hurricane Barrier Project
Shaw Cove, New London, Connecticut

As requested in your letter of February 10, 1975, the Department of Transportation has reviewed the preliminary plan of the Hurricane Barrier Project proposed for the Shaw Cove area in New London.

Our review has indicated that the Barrier Project will not adversely affect our existing facilities or any projects planned in the general New London area.

Very truly yours,

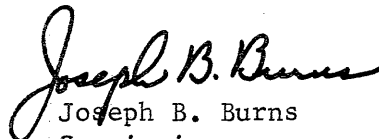

Joseph B. Burns
Commissioner

EXHIBIT 10



U. S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
REGION ONE
990 Wethersfield Avenue
Hartford, Connecticut 06114

February 25, 1975

IN REPLY REFER TO:

01-09.3

Mr. John Wm. Leslie
Chief, Engineering Division
Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Leslie:

Mr. R. E. Kirby, Regional Federal Highway Administrator, has asked that I reply for him on the proposed New London Hurricane Barrier.

We have reviewed your proposed location plan submitted on February 10 for its impact on the Federal-aid highway system.

One roadway is affected, Howard Street, which was added to the Primary Type II system at the request of the City. This made it eligible for TOPICS funding. Howard Street will apparently be cut in two by the proposal and may therefore have to be removed from the Federal-aid system. However, as the city, according to your letter, is in agreement with the plan we have no objection, and will take action to initiate the system change.

We are submitting your plan to the Connecticut DOT for their information and action. Should they have any comments they will submit them directly to you.

Sincerely,

D. J. Altobelli
Division Engineer

EXHIBIT 11



STATE OF CONNECTICUT
STATE DEPARTMENT OF HEALTH
79 ELM STREET HARTFORD, CONNECTICUT 06115



OFFICE OF PUBLIC HEALTH

February 20, 1975

566-4081

Attention: NEDED-E

Mr. John Wm. Leslie, Chief, Engineering Division
Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Leslie:

We have reviewed the report on the revised New London Hurricane Barrier Project, New London, Connecticut.

The Connecticut State Department of Health offers no comment to the proposal.

Very truly yours,

Harold S. Barrett, M.D.
Deputy Commissioner

HSB/b

EXHIBIT 12

NEW ENGLAND RIVER BASINS COMMISSION

NERBC

55 COURT STREET • BOSTON, MASSACHUSETTS 02108
PHONE (617) 223-6211

March 13, 1975

Mr. John Wm. Leslie
Chief, Engineering Division
U. S. Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear John:

The Long Island Sound Study staff is so tied up in report review that there is no way to take the time to respond constructively on the New London Hurricane Barrier project.

I would assume that the State of Connecticut would use the Long Island Sound report as one basis for developing its own response.

Yours very truly,


Frank Gregg
Chairman

FG/n



**DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD**

MAILING ADDRESS
COMMANDER (oan)
FIRST COAST GUARD DISTRICT
150 CAUSEWAY STREET
BOSTON, MASS. 02114

Tel: 617 223-3632

3260

1975

Mr. John Wm. Leslie
Chief, Engineering Division
Department of the Army
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, MA 02154

Dear Mr. Leslie:

I am in receipt of your letter NEDED-E dated 10 February 1975 regarding the proposed New London Hurricane Barrier Project. Please be advised that New London is geographically located in our Third Coast Guard District. Thus, I have forwarded your letter with all enclosures to Commander (oan), Third Coast Guard District, Governors Island, New York, New York 10004, for their comments.

Sincerely,

R. W. Vail
R. W. VAIL
Lieutenant (JG), U. S. Coast Guard
Operations Officer
Aids to Navigation Branch
By direction of the Commander
First Coast Guard District

Copy to:
Commander (oan), Third Coast Guard District

EXHIBIT 14



DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS:

Commander (mep)
Third Coast Guard District
Governors Island
New York, New York 10004
(212) 264-4916

5922/19.bI
13/75

MAR 13 1975

Mr. John Wm. Leslie, Chief
Engineering Division
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Leslie:

We are responding to your letter of 10 February, which seeks to coordinate the reformulation of plans for the New London Hurricane Barrier Project, being undertaken by your Agency.

A review of the reformulated plan ("INCL 2," attached to your letter), indicates that existing Coast Guard facilities in the area, under the command of Coast Guard Group Long Island Sound, will not be adversely affected.

The above review should not be interpreted as an evaluation of the project's effectiveness or of its possible environmental impacts.

Sincerely yours,

W. R. JURGENS

Lieutenant, U. S. Coast Guard
Acting Chief, Marine Environmental Protection Branch
By direction of the District Commander

cc:
Commander, Group Long Island Sound

EXHIBIT 15



DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

AREA OFFICE

999 ASYLUM AVENUE, HARTFORD, CONNECTICUT 06105

AREA OFFICES
Boston, Massachusetts
Hartford, Connecticut
Manchester, New Hampshire

October 16, 1975

IN REPLY REFER TO:

REGION I
REGIONAL OFFICE
BOSTON, MASSACHUSETTS

Mr. George Sarandis
Project Engineer
U. S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Sarandis:

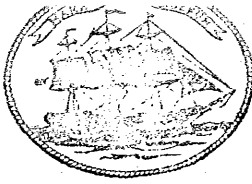
Subject: Urban Renewal Project Conn. R-126
(Shaw's Cove)
New London, Connecticut

This is to advise you that the flood protection to be provided by the U. S. Army Corps of Engineers for the Shaw's Cove Project, Conn. R-126 is a mandatory and integral part of the urban renewal plan and HUD's involvement in the project area.

Sincerely,

Daniel P. Kolesar
Director
Community Planning & Development Div.

EXHIBIT 16



**CITY OF NEW LONDON
CONNECTICUT**

April 20, 1976

Colonel John H. Mason
Division Engineer
U.S. Army Corps of Engineers
New England Division
424 Trapelo Road
Waltham, Massachusetts 02154

RE: NEW LONDON HURRICANE PROTECTION
New London, Connecticut

Dear Colonel Mason:

This letter is to assure you of our need for adequate funding and construction of the Land-Based Hurricane Protection Project proposed by the Corps for the Shaw's Cove area. Not only will lives and property be protected in a significant part of our community, but the integrity of our on going \$20,000,000, HUD funded, Shaw's Cove Urban Renewal Project will be insured.

This urban renewal project has been in execution since 1973 with land acquisition 80% complete, clearance 50% complete, and site improvement contracts underway. Land is and will continue to be available for Corps construction and no delays are anticipated.

The City of New London has been and continues to be prepared to execute appropriate assurances and to provide the local share of costs for the flood protection project as required.

Sincerely,

C. Francis Driscoll
City Manager

D:s

EXHIBIT No 17

APPENDIX B

PRELIMINARY ESTIMATE OF REAL ESTATE COSTS

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS

PRELIMINARY ESTIMATE OF REAL ESTATE COSTS

NEW LONDON HURRICANE PROTECTION PROJECT

(GDM REVISED)

NEW LONDON, CONNECTICUT

29 MARCH 1977

PREPARED BY

David P. Clark
DAVID P. CLARK
Appraiser

REVIEWED BY

William D. Brown, Jr.
WILLIAM D. BROWN, JR.
Reviewing Appraiser

APPROVED BY

William R. Coke
WILLIAM R. COKE
Chief, Appraisal Branch

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PURPOSE

The purpose of this report is to estimate the real estate costs for the New London Hurricane Barrier Project as of 12 January 1977.

AUTHORIZATION

The hurricane-flood protection plan for New London, Connecticut, was authorized by the Flood Control Act of 1962 (Public Law 87-874, 87th Congress), dated 23 October 1962, which reads in part as follows:

"The Project for hurricane-flood protection at New London, Connecticut, is hereby authorized substantially in accordance with the recommendations of the Chief of Engineers in House Document Number 478, Eighty-seventh Congress."

These recommendations have been revised to reflect changing local interests and a revised GDM #2 has been authorized by The Water Resources Development Act of 1976, Public Law 94-587, dated 22 Oct 76.

LOCATION

Hurricane protective measures are to be constructed along the perimeter of Shaws Cove on the west side of New London Harbor about 2.5 miles upstream of the mouth of the Thames River in New London, Connecticut. Shaws Cove is situated on the southeast side of the City near the urban center. The surrounding neighborhood is an old residential-commercial area which has now been partially cleared by the New London Redevelopment Agency.

AREA DESCRIPTION

The City of New London is bordered on the south by Long Island Sound, on the east by the Thames River, and on the north and west by the Town of Waterford.

The City has a land area of 6.25 square miles and is almost entirely built-up. The current population is estimated at 30,200 persons.

The lack of land available for building has inhibited any population expansion as is evidenced by a decrease of 350 over the 1950 census of 30,550 persons, and a decrease of 1,500 from the 1970 population. The City is a substantial commercial center which serves a large population within a 30-mile radius. The prosperity of the area is heavily dependent on manufacturing, and there are many diversified industrial concerns in New London. The principal industries are: shipbuilding and ship repair, marine construction and manufacture of collapsible tubes, dentifrice, floor coverings, chucks, broaches, paper products, turbines, women's and children's wear, doors, windows, interior trim, food products, and metal toys. The Electric Boat Division of General Dynamics Corporation in nearby Groton which designs and builds submarines, is the largest employer in the region with almost 14,000 employees. Transportation facilities in the area are good. The City is served by U.S. Routes 1 and 95, the Connecticut Turnpike, and State Routes 32 and 85. Rail service is provided by the Penn Central Transportation Company. Bus service is provided by several companies. Ferry service is available from New London to Fisher's Island and Long Island, New York. Nearby airports include the New London Airport in neighboring Waterford and Trumbull Airport in Groton.

Most required services and facilities are available in the City including police and fire protection. The City is served by several newspapers including a local daily newspaper (THE DAY) with a circulation of about 36,000. There is a local radio station (WNLC). The public school system is good, and there is a parochial high school and two parochial elementary schools. Connecticut College and Mitchell College are situated in the City. The City has 25 churches, representing most major denominations, a large amusement park, Ocean Beach Park, and many recreational facilities. A public library system and a hospital are available. The local Government is presided over by a City Council and Manager. The current tax rate is 63.14 mills. The fair market value assessment ratio is 65 percent. The City has zoning regulations, a central water supply and a public sewage disposal system. New London has an active Urban Renewal Program and Model Cities Program, and redevelopment of a portion of the City has been accomplished. Lands are currently being acquired for urban renewal in the Shaws Cove Area.

There are large military installations in this area, including the U.S. Navy Underwater Sound Laboratory at Fort Trumbull, the New London Submarine Base located along the east bank of the Thames River, and the U.S. Coast Guard Academy.

DESCRIPTION OF SUBJECT SITE

The Shaws Cove area of New London is one of the older areas of the City with evidence of early commercial and industrial development as well as residential use. The south side of the Cove is primarily developed with very old industrial property and old single family and two-family homes in various stages of disrepair. The west side of the Cove was composed mostly of old residential units surrounding a low area which is the delta of the Truman Brook as it empties into the Cove. These residential units have been demolished. Some of the land has been filled in past years, but the area remains subject to flooding and has experienced recurring flood damage in the past. The north side of the Cove was developed with old commercial establishments which have deteriorated in recent years. The east side of the Cove is partially protected from the Thames River, but is open at the Railroad Bridge and therefore, exposed to the effects of wind and tides from the sea. Most of the residences on the west side of the Cove, and the commercial establishments on the north side of the Cove along Bank Street have been removed since 1974 in the course of urban redevelopment.

PROJECT DESCRIPTION AND LAND REQUIREMENTS

The project consists basically of the construction of walls, dikes and land fill around the north and west shores of Shaws Cove in New London, to prevent periodic inundation of the surrounding flood prone lands. The elevation of the areas on the west and north of the Cove is about 5 feet above mean sea level. Wind and tide conditions often combine to flood these low areas. The planned combination of protective measures will elevate portions of the area and provide protective barriers for others to the 10.5-foot elevation above mean sea level. This elevation is the 100-year flooding frequency level which is planned to provide sufficient protection to this area of New London.

Land requirements for construction of the protection include: Land area for a Bank Street-Sparyard Street dike and wall, an oil storage protection wall, area for a pumping station and pressure conduit, and berm areas required to support regrading.

Permanent easements and fee interests for the dike and concrete "L" wall inclosing the Bank Street to Sparyard Street area will require about 21,780 square feet of land. Additional fee interests and permanent easements for the area from Sparyard Street to the southwest side of the Cove including an oil storage facility, a pumping station, and a pressure conduit will require an additional 156,750 square feet of land. Temporary easements for The City Coal Company work area and the pressure conduit will require an area of approximately 28,000 square feet.

RECAPITULATION OF PROJECT LAND AREAS

PERMANENT EASEMENT AND FEE INTEREST

a. Bank Street to Sparyard Street	21,780
b. Sparyard Street - Coal Company Land	30,000
c. Oil Storage Facility	9,000
d. Pumping Station	15,250
e. Pressure Conduit	7,500
f. Oil Facility to Hamilton Street	<u>95,000</u>

Total 178,530 Sq. Ft.

TEMPORARY EASEMENTS

a. Pressure Conduit - Jefferson Street	18,000
b. City Coal Company (Work Area)	<u>10,000</u>

Total 28,000 Sq. Ft.

CONCRETE "L" WALL

Commencing at Bank Street, on the north side of Shaws Cove, a concrete "L" wall would extend south to the main line of the Penn Central Transportation Company, then southwest parallel to the railroad to Sparyard Street, a distance of 500 feet. Sparyard Street would be regraded as a ramp to provide access from Bank Street to the unprotected properties on the north bank of the Cove. Acquisition of Bank Street properties may involve provision for access and severance damages to properties south of the railroad lands. Provision for any additional costs due to damages or awards for these lands has been anticipated in contingency costs estimated for this project.

STORAGE FACILITY FLOODWALL

The oil storage facility (City Coal Company), bounded by Bank Street on the north and Shaws Cove on the south, is an exception to the proposed regrading since this private property will not be displaced by the urban redevelopment project. This property will be protected by a 300-foot long floodwall with a top elevation of 10.5 MSL. The floodwall would consist of ten (10), 20-foot diameter circular steel sheet cells with a reinforced concrete "L" wall. This plan prevents damage to existing oil tanks and avoids interference with existing structures.

PUMPING STATION AND PRESSURE CONDUIT

A pumping station is to be located on the west side of the oil storage facility. The station would provide pumping capacity for low

areas which are not planned to be regraded. The capacity of the pumping station has been planned as 210 C.F.S. for flood control requirements.

Assubsurface pressure conduit will extend northerly from the proposed pumping station in lands in the urban renewal area to Bank Street, and then westerly along the south side of Bank Street to Jefferson Avenue. Permanent easements will be required along this conduit alignment. The conduit will divert Truman Brook from Grand Street to the pumping station at Shaws Cove to eliminate the flooding of the plain west of Howard Street which is the center of the area now under redevelopment in New London. The course of the proposed pressure conduit is chiefly within street rights of way in the City of New London, including about 500 feet of State Route 1A between Jefferson Avenue and Truman Street and in property now owned or soon to be acquired by the New London Redevelopment Agency.

REGRADED URBAN AREA

The area which has been proposed for regrading to elevation 10.5 MSL is bounded by Bank Street on the north, Shaw Street on the west, and Hamilton Street on the south.

The area required for flood protection extends from the Pumping Station and Pressure Conduit area along the north and west banks to Hamilton Street, a distance of about 1,900 feet.

BORROW AREA

No land has been included in this report for borrow purposes, although it has been reported that the City of New London owns properties which are suitable as a source of impervious fill. The quality and quantity is unknown.

RELOCATIONS

a. Howard Street which parallels the west side of the Cove is to be relocated to accommodate redevelopment plans. This street relocation has been contracted and is currently underway under the authority of the New London Redevelopment Agency.

b. Sparyard Street will be raised in place to assure all-weather access to property of others.

PRESENT USE AND HIGHEST AND BEST USE

The land required for the eastern segment of the proposed barrier is rear land and shoreline land. It lies to the rear of Bank Street

commercial establishments and is now used for storage and vehicle parking. The property required for protection on the west side of the Cove was primarily residential in use with numerous old obsolete and deteriorated dwellings. All of the land required for this project, except the pressure conduit area, is within the redevelopment area, and its highest and best use is considered to be those uses associated with current urban redevelopment planning.

MINERAL DEPOSITS

Field inspection of the subject property disclosed no evidence of commercial mining nor any minerals nor gravel deposits of any commercial value within the project area.

AGRICULTURE

There is no evidence of agricultural activity within the project area.

UTILITIES AND SERVICES

Electric power, telephone service, City water and sewer, trash collection, police and fire protection are available to properties within the project area.

OUTSTANDING WATER RIGHTS

Truman Brook Area - Because of the proposed diversion of Truman Brook, 11 abutting ownerships will be affected. As part of the construction, it is planned to fill the brook ditch in keeping with existing grades. No estimated damages are anticipated because of the diversion.

Shaws Cove Area - One ownership, and oil distribution company will be denied direct access to its oil distribution docks. Construction has been planned, however, to afford access over the protective floodwall to the oil docks and the dockside intake pipelines.

ZONING

The City of New London has a zoning ordinance adopted in 1969 and amended in June 1972. The project areas are zoned for Neighborhood Commercial, Central Business, and Light Industrial uses. The Commercial zone on Bank Street extends back 150 feet to an area of Light Industrial Zoning which includes most of the barrier portion of the project. The east side of Howard Street is zoned for Neighborhood Commercial activity and most of Hamilton Street is zoned for Light Industry. The area from Sparyard Street east along Bank Street is zoned for Central Business.

It is probable that with the implementation of current plans for redevelopment the foregoing zoning areas will be changed to reflect the proposed new uses of the developed area.

TAX LOSS

For the purposes of this report, no tax loss is anticipated since realization of Redevelopment Agency goals and completion of this project should provide a tax base increase for the City of New London.

PROTECTION AND ENHANCEMENT OF ENVIRONMENT

In accordance with instructions set forth in teletype DA(DAEN) R 191306, dated October 1971, Subject: "E011593, 13 May 1971, Protection and Enhancement of Cultural Environment", a study has been made in the subject areas. The study revealed that no local, state, federally-owned, nor federally-controlled property of historical significance would fall within the provisions of E011593.

GOVERNMENT/MUNICIPALLY-OWNED FACILITIES

There are no Governmental/Municipally-owned facilities located within these areas. Therefore, no cost has been included in this report for the protection, alteration, relocation, or replacement of such facilities as provided under Section 111, Public Law 85-500, 3 July 1958.

ACQUISITION COSTS

Experience in this office in acquiring properties in other Civil Works Projects indicates that acquisition costs include mapping, surveys, legal descriptions, title evidence, appraisals, negotiations, closing and administrative costs or possible condemnation. The number of ownerships within the project area were computed from local assessor's maps which are considered to be reasonably accurate. The number of tracts were estimated by counting the affected ownerships and through discussions with local officials. Based upon this survey, the acquisition costs are estimated as follows:

12 Ownerships @ \$2,500 = \$30,000

RECOMMENDATIONS AND ESTATES TO BE ACQUIRED

A portion of the lands covered in this report are required for permanent structures, such as dikes, berms, and floodwalls. It is recommended that fee simple title be acquired for the lands within the barrier alignment. Lands required for the pressure conduit are recommended to be acquired by permanent easement since the conduit is almost entirely of near grade surface construction. Temporary construction easements for work areas will be required for a two-year period.

TEMPORARY CONSTRUCTION EASEMENTS

Temporary easements of varying widths will be required for work areas during construction. These easements extend parallel to the berms and floodwalls in the project, as well as the land areas to be filled and regraded. The costs of temporary easements are predicated upon a fair return of invested capital for the use of the owners' land for a two-year period. The lands involved in this project have been acquired or soon to be acquired by the New London Redevelopment Authority as part of an urban renewal program. There is one private ownership involved in the areas to be elevated, and 11 private ownerships affected along the course of the pressure conduit.

The private ownership of the City Coal Company of New London will require a temporary work easement over an area estimated to be 10,000 square feet. Estimating a unit value for land in the area (as indicated by recent sales), a fee value for the parcel was derived. Assigning a 15 percent return for capital invested, 15 percent of the fee value for two years is estimated for a reasonable easement compensation.

Temporary work easements may be required on private properties on the north side of Jefferson Street which may be affected during the installation of the pressure conduit. An additional 25 feet of easement area, where available because of improvements, should be acquired to supplement the 25 feet of right of way in Jefferson Street (north side from center-line), for a distance of 720 feet. Estimating a value per square foot for the privately-owned land (as indicated by recent sales), a total fee value is derived. A 15 percent return for capital invested for two years is estimated as temporary work easement compensation for planning purposes.

RELOCATION ASSISTANCE

Public Law 91-646, Uniform Relocation Assistance and Real Property Act of 1970, provides for uniform and equitable treatment of persons displaced from their homes, businesses, or farms by Federal and Federal assisted programs. In accordance with this Law, the Redevelopment Agency has made provisions for Relocation Assistance Costs incurred during the acquisition of the redevelopment lands and no additional costs to the acquiring authority are anticipated. Twelve private ownerships will be affected by construction, and Relocation Assistance Costs are estimated to be \$300 per ownership or

$$12 \times \$300 = \$3,600$$

The \$300 estimate per ownership provides for only costs incurred incidental to the transfer of the real estate interest required.

SEVERANCE DAMAGES

Severance damages sometimes occur when partial takings are acquired and when the remaining portions may not be subject to full economic development. The severance damages are measured by the "Before and After" appraisal method, and will reflect actual value losses incurred to the remainder as a result of partial acquisition. The total severance damages incurred by the proposed acquisition is estimated to be \$24,000.

CONTINGENCIES

A contingency allowance of 20 per cent is considered to be reasonably adequate to provide for possible appreciation of property values from the time of this estimate to acquisition date, for possible minor line adjustments, or for additional hidden ownerships which may be developed by refinement of taking lines, for adverse condemnation awards, and to allow for practical and realistic negotiations.

CONCLUSIONS

The areas to be utilized, as set forth in this report, are considered to be reasonably accurate. The final determination of the lands to be acquired within the scope of this project will be predicated upon survey and detailed field investigation.

The value of the real estate interests have been estimated by use of the market data or comparative sales approach. This approach to value is premised on comparison between the lands to be acquired, and recent sales of comparable lands in the general vicinity. For purposes of this report, the gross land values presented in the project recapitulation of real estate costs were estimated on average unit values.

During the real estate study, the appraiser reviewed public records and contacted many knowledgeable persons, including private individuals, city officials, and personnel from the New London Redevelopment Agency. The real estate investigation included on-site inspection of the areas involved to determine their highest and best use, and physical characteristics. As a result of this study, many sales of properties considered comparable to the lands affected by the proposed acquisition were noted and compared to the subject areas,

In conclusion, consideration was given to all items which might have an influence upon the final real estate cost. There follows a summary of the estimated real estate cost for the New London Hurricane Barrier Project.

COST SUMMARY

Land Costs	\$714,120
Temporary Construction Easements	33,600
Severance Costs	24,000
Relocation Assistance Costs	3,600
Acquisition Costs	30,000
Contingency Costs (20% of \$805,320)	<u>161,064</u>
	\$966,384
Called	\$970,000

CERTIFICATION

This is to certify that I have personally inspected the lands described herein, that the facts and data used are, to the best of my knowledge and belief, true and correct, and that the appraised values and costs represent my best and unbiased judgment of the fair market value of the subject lands. I have no present or intended future interest in the property.

23 March 1977
Date

David P. Clark
DAVID P. CLARK
Appraiser

APPENDIX C
PRESSURE CONDUIT

REPORT TO THE ARMY CORPS OF ENGINEERS

on the

PROPOSED PRESSURE CONDUIT
BANK STREET TO GRAND STREET

SHAW'S COVE URBAN RENEWAL PROJECT

CONN. R-126

NEW LONDON, CONNECTICUT

THE REDEVELOPMENT AGENCY
FOR THE
CITY OF NEW LONDON

CAHN ENGINEERS, INC.

July 1975

Revised March 1975
November 1976

#11 110 AB

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IV. APPENDIX - PLAN OF PRESSURE CONDUIT.....	

Cahn Engineers Inc.

NEW LONDON PRESSURE CONDUIT

PURPOSE

The purpose of this Report is to outline for the U. S. Army Corps of Engineers and the New London Redevelopment Agency, the important engineering aspects and preliminary cost estimates for the construction of a pressure conduit facility in conjunction with the Corps Flood Protection Project and the Shaw's Cove Urban Renewal Project. The information herein and on the attached enclosures will be utilized by the Corps of Engineers in gaining full approval of this project during the final design stage.

DESCRIPTION

The proposed pressure conduit will be installed starting at a point near existing Shaw's Cove east of Howard Street heading northerly to Bank Street and then westerly in Bank Street to Garibaldi Square. It will then continue northwesterly in easements adjacent to Truman Brook to Grand Street where it will intercept the existing Truman Brook. The purpose of the pressure conduit will be to bypass the proposed Corps of Engineers Pump Station with a substantial amount of

Cahn Engineers Inc.

runoff from the Truman Brook watershed. With the pressure conduit, pumping will not be required from the area serviced by the conduit during critical rain storms or during times when the outlet water elevation in the Cove would prevent discharge from a gravity system.

The New London Redevelopment Agency will be installing the necessary auxiliary gravity system in Bank Street up to the inlet of the proposed pump station to serve those areas not serviced by the pressure conduit and from which flows may have to be pumped during critical periods. The attached sketch shows the various drainage areas entering both the pressure conduit and the auxiliary gravity storm drain systems. In addition, enclosed with this report are preliminary design computations for the sizing of both the pressure conduit and the auxiliary gravity system.

These computations address themselves to the criteria established by the Corps of Engineers for the sizing of the pressure conduit. That is, the Corps has indicated that the conduit should be sized for the more critical of the two following situations:

1. Runoff from a 100 year storm against a 10 year Cove elevation.

Cahn Engineers Inc.

2. Runoff from a 10 year storm against a 100 year Cove elevation.

The 100 year storm runoff against a 10 year Cove elevation has been found to be the most critical.

The State of Connecticut has initiated construction of the Colman Street Drainage Project which will divert the northern portion of the Truman Brook watershed away from the area naturally tributary to Shaw's Cove.

The Corps of Engineers has requested that the pressure conduit include capacity for runoff from the Colman Street Project in excess of the design storm used by the State and up to the 100 year storm.

Applying the design criteria and parameters used for the Pressure Conduit to the State Project, we have determined that the capacity of the State system, downstream of the point at which runoff would enter the Truman Brook watershed, is adequate to handle design flows based on a 100 year storm.

We have therefore predicated the design of the Pressure Conduit on an area exclusive of that intercepted by the Colman Street Project.

Project SHAW'S COVE URBAN RENEWAL AREA
Computed By R.D.N. Checked By _____
Field Book Ref. _____ Other Refs. SI-2 Pressure
CONDUIT
CE 1110 AB

Sheet 4 of 19
Date 3/12/75
Revisions 11/10/76 Per

PRESSURE CONDUIT - COMPARISON OF THE FOLLOWING DESIGN CRITERIA

- I 100 year Storm & 10 year Tailwater Elevation in Shaw's Cove
II 10 year Storm & 100 year Tailwater Elevation in Shaw's Cove

I. a) Area Tributary to Proposed Pressure Conduit = 250 acres
tc (time of concentration) = 47 minutes
I_{100 year} = 3.4 in./hr.
C (coefficient of imperviousness) = .60

Using Rational Method:

$$Q = CIA = (.60)(3.4 \text{ in./hr.})(250 \text{ acres}) = \underline{\underline{510 \text{ cfs}}}$$

b) Tailwater Elevation = +6.5 m.s.l.
Headwater Elevation (allowable) +23.0 m.s.l.
Net available head 16.5 feet

c) Losses = Friction + Minor Losses

$$\text{Minor Losses} = \frac{3V^2}{2g} \text{ including:}$$

1 entrance loss @ $.50 \frac{V^2}{2g}$	=	$.50 \frac{V^2}{2g}$
1 exit loss @ $1.00 \frac{V^2}{2g}$	=	1.00
2 90° x @ .35	=	.70
2 60° x @ .20	=	.40
2 45° x @ .20	=	.40

$$\underline{\underline{\text{TOTAL} \quad 3.0 \frac{V^2}{2g}}}$$

Project SHAW'S COVE URBAN RENOVATION AREA
 Comp. By R.D.N. Checked By _____
 Field Book Ref. _____ Other Refs. SI-2
CG 11 110 AL

Sheet 5 of 19
 Date 3/12/75
 Revisions _____

$$\text{Try } 96" \phi @ h_L = .42\% \quad Q_{\text{drop}} = 515 \text{ CFS} \quad R = .015$$

$$\text{Length of Conduit} = 2720 \text{ LF}$$

$$\text{Losses} = (2720 \text{ LF})(.0042) + \frac{(3.0)(10.2 \text{ ft/sec})^2}{(2)(32.2 \text{ ft/sec}^2)} = 16.2 \text{ feet} < 16.5 \text{ ft} \therefore \text{OK}$$

Use 96" ϕ Pipe

2) Area = 250 acres
 $t_c = 47 \text{ minutes}$
 $I_{\text{avg}} = 2.2 \text{ in/hr}$
 $C = .6$

$$Q = (.6)(2.2 \text{ in/hr})(250 \text{ acres}) = \underline{330 \text{ CFS}}$$

b) Tailwater Elevation = +10.6 m.s.l.
 Headwater Elevation (allowable) +23.0 m.s.l.
 Net available head = 12.4 feet

c) Try 90" $\phi @ h_L = .25\% \quad V_{\text{full}} = 7.6 \text{ ft/sec}$

$$\text{Losses} = (2720 \text{ LF})(.0025) + \frac{(3.0)(7.6)^2}{(2)(32.2)} = 9.5 \text{ feet} < 12.4 \text{ feet} \therefore \text{OK}$$

Use 90" ϕ Pipe

Project SHAWNEE COVE UPRAMP RENOVATION

Computed By P.D.N.

Checked By _____

Field Book Ref. _____

Other Refs. SI-2

CS 11110 AB

Sheet 6 of 19

Date 3/12/75

Revisions _____

Conclusion: Since a larger diameter pressure conduit is required for protection against the 100 yr Storm & 10 year Cove elevation versus the 10 yr Storm & 100 yr Cove elevation, the former criteria has been determined to be more conservative and will be utilized for the design of the pressure conduit.

Project SHAWS COVE U.R.A.
Computed By R.D.N. Checked By B.J.
Field Ref. _____ Other Refs. ST-2

Sheet 7 of 19
Date 2/25/75
Revisions _____

CE 1110A

Prop Auxiliary Gravity Storage System - In Bank St

DESIGN STORM = 10yr FREQUENCY

I From Garibaldi Square & West

a) AREA - South of Bank Street 30 acres
- North of Bank Street None
Total 30 acres

b) Coefficient of Imperviousness $C = .50$

c) time of concentration = 30 min

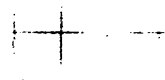
d) $I_{10yr} = 3.0 \text{ in/hr}$

$$Q = CIA = (.50)(3.0 \text{ in/hr})(30 \text{ acres}) \\ = \underline{\underline{45 \text{ cfs}}}$$

$$\begin{array}{l} \text{Use } 42" @ S = .20\% \quad V = 4.7 \text{ ft/sec} \\ 36" @ S = .45\% \quad V = 6.2 \end{array} \left. \vphantom{\begin{array}{l} 42" @ S = .20\% \\ 36" @ S = .45\% \end{array}} \right\} R = .013$$

II From Garibaldi Square to Howard Street

a) Area - South of Bank Street 7 acres
- North of Bank St (Tramway Brook) 24 acres
Total 31 acres



b) $C_{avg} = .50$

c) $t_c = 30 \text{ min}$

d) $I_{10yr} = 3.0 \text{ in/hr}$

$$Q = (.50)(3.0)(31 + 30) \\ = 91.5 \text{ cfs} \quad \underline{\underline{\text{say } 92 \text{ cfs}}}$$

Project SHAW'S COVE URBAN RENOVATION
Computed By R.D.N. Checked By B.J.
Field Book Ref. _____ Other Refs. SI-2
CE 1110 AB

Sheet 8 of 19
Date 2/25/75
Revisions _____

USE 72" @ $S = .05\%$ $V = 3.3 \text{ ft/sec}$
66" @ $S = .08\%$ $V = 3.9 \text{ ft/sec}$
60" @ $S = .12\%$ $V = 5.2 \text{ ft/sec}$
54" @ $S = .22\%$ $V = 5.8 \text{ ft/sec}$
48" @ $S = .44\%$ $V = 7.5 \text{ ft/sec}$

III From Howard St to a Point approx 250' east of Howard St

a) Area - South of Bank Street 17 acres
North of Bank Street 78 acres
Total 95 acres

b) $C_{avg} = .50$

c) $t_c = 40 \text{ min}$

d) $I_{10yr} = 2.4 \text{ in/hr}$

$$Q = (.50)(2.4)(61 + 95) \\ = 187.2 \text{ cfs SAY } \underline{187 \text{ cfs}}$$

USE 72" @ $S = .20$ $V = 6.6 \text{ ft/sec}$
66" @ $S = .35$ $V = 8.2 \text{ ft/sec}$

IV From a point approx 250' east of Howard St to Shaw's Cove.

a) Area - South of Bank Street - 13 acres
North of Bank Street - 44 acres

Total 57 acres

Project SHAW'S COVE URBAN RENEWAL
Computed By R.D.N. Checked By BJ
Field Book Ref. _____ Other Refs. SI-2
CE 11110 AB

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Date 2/25/75
Revisions _____

b) $C_{avg} = .50$

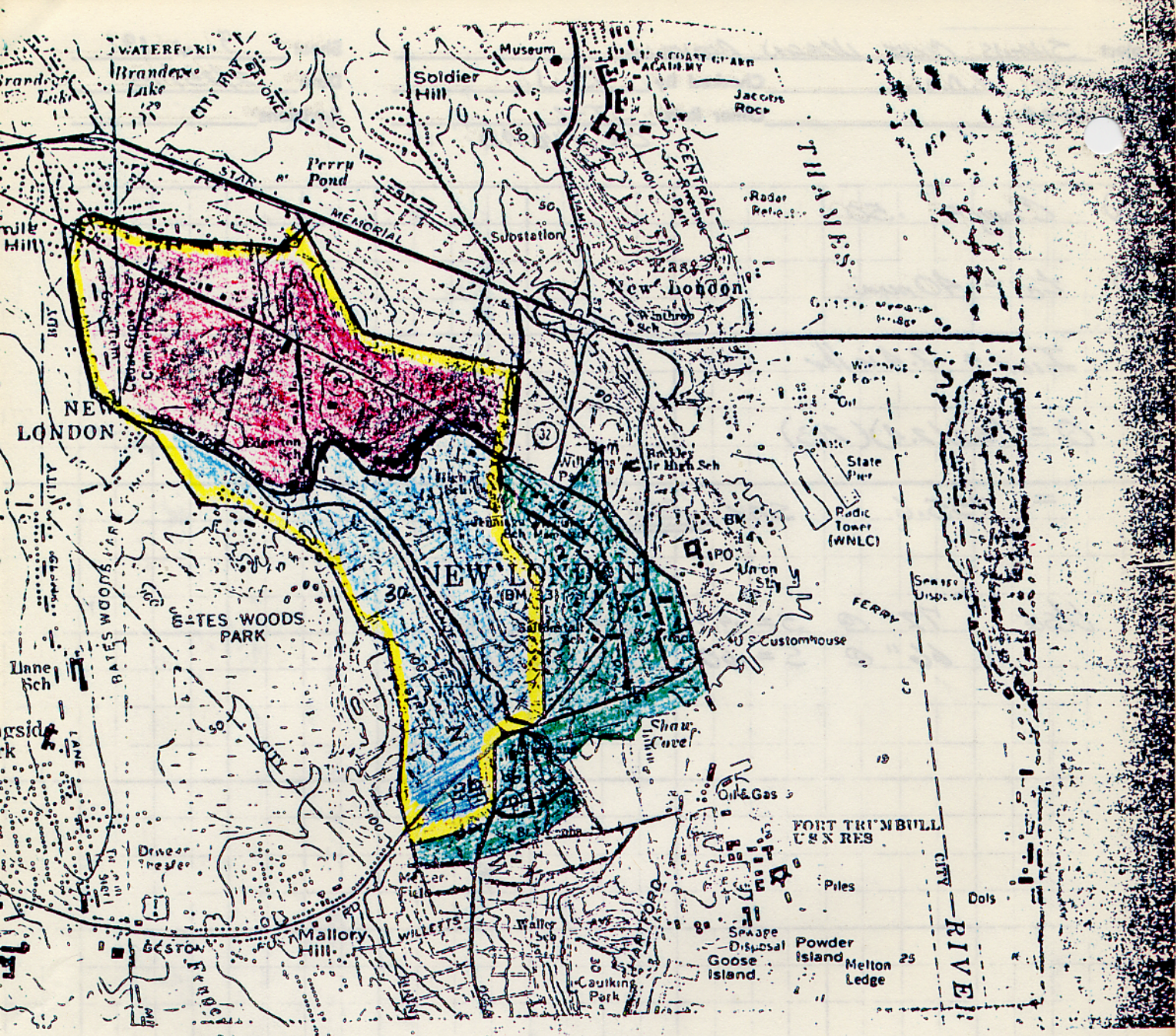
c) $t_c = 40 \text{ min}$

d) $I_{four} = 2.4 \text{ in/hr}$

$Q = (.50)(2.4)(71.3)$

$= 255.6 \quad \text{SAY } \underline{\underline{256 \text{ CFS}}}$

Use $72" @ S = .40 \quad V = 9.2 \text{ ft/sec}$
 $66" @ S = .60 \quad V = 11.0 \text{ ft/sec}$



Scale 1" = 2000'

LEGEND

550 acres



AREA TRIBUTARY TO PRESSURE CONDUIT PRIOR TO COLMAN STREET DRAINAGE PROJECT

300 acres



AREA DIVERTED AWAY FROM TRUMAN BROOK WATERSHED BY COLMAN ST. DRAINAGE PROJECT

250 acres



AREA TRIBUTARY TO PRESSURE CONDUIT AFTER COLMAN STREET DRAINAGE PROJECT

215 acres



AREA TRIBUTARY TO AUXILIARY GRAVITY DRAIN DISCHARGING TO PROP. STORM WATER PUMP STATION

Project Shaw's Cove Urban Renewal
Committed By R.D.N. Checked By _____
Field Book Ref. _____ Other Refs. C.E. 11110 AB SI-2
PRESSURE CONDUIT

Sheet 1-3 of 19
Date 11/11/76
Revisions _____

PRELIMINARY CONSTRUCTION ESTIMATE - PRESSURE CONDUIT

COST TO THE CORPS OF ENGINEERS

1. PIPE

2750 L.F. OF 96" dia. Pressure Conduit @ \$400/LF = \$1,100,000

2. Excavation (for 96" Pipe)

Trench excavation - Earth

18,300 CY @ \$10/CY = \$183,000

Trench excavation - Rock

2,000 CY @ \$20/CY = \$40,000

\$223,000

3. Pavement Repair

600 SY @ \$20/SY = \$12,000

\$12,000

4. Maintenance & Protection of Traffic

Total 1-3

\$1,335,000

5% M & PT = (0.05)(1,335,000) = 66,800

66,800

\$1,401,800

CONTINGENCIES

218,200

\$1,620,000

5. TOTAL CONSTRUCTION COST

6. Corps Share of Construction Cost

70% x Total Construction Cost = (0.70) \$1,620,000 = \$1,134,000

COST TO FEDERAL GOVERNMENT

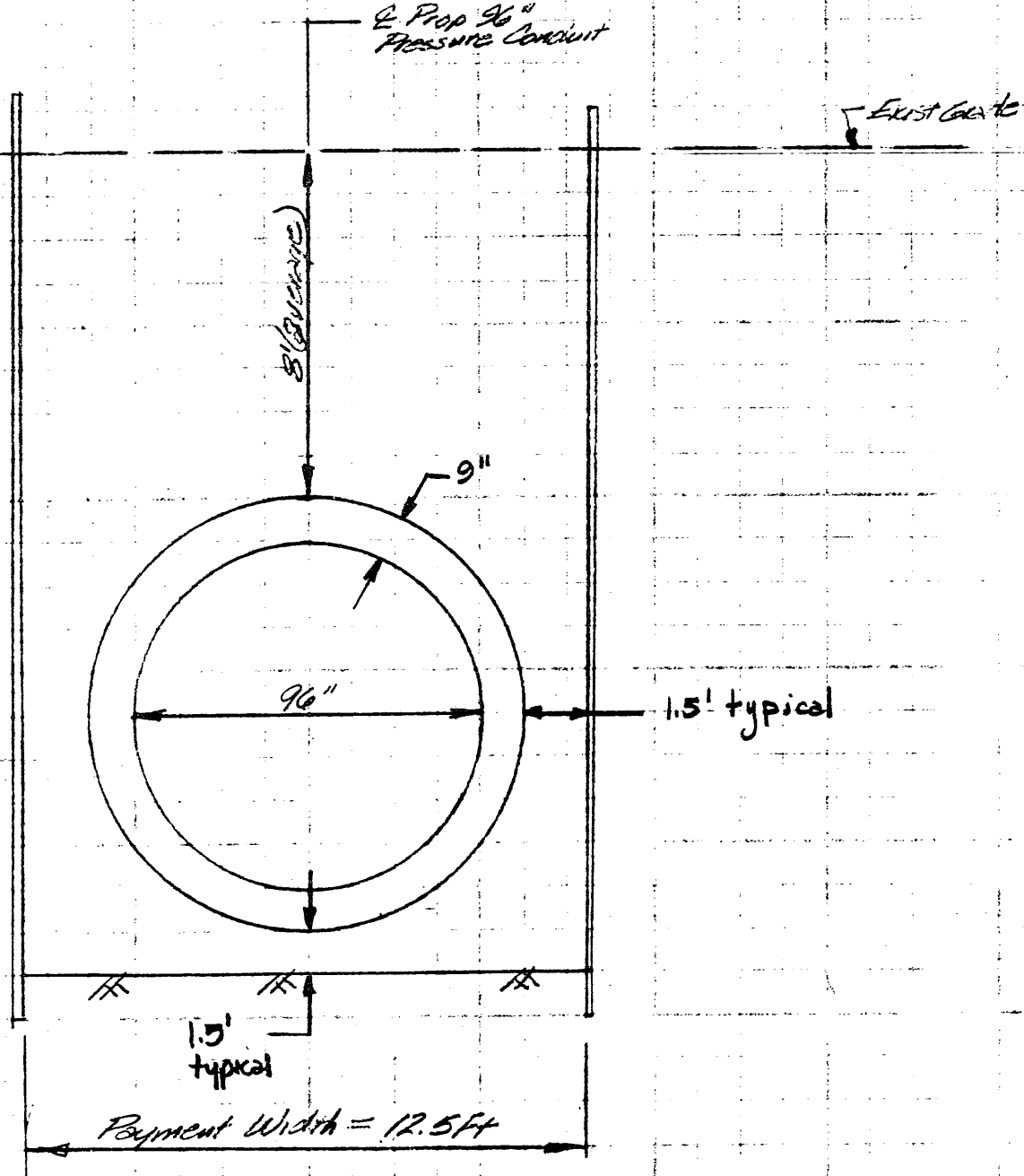
SUMMARY

Pipe incl Emergency Closure Gate	\$1,100,000
Excavation Earth	183,000
Excavation Rock	40,000
Pavement Repair	12,000
Maintenance and Protection of Traffic	66,800
	<u>\$1,401,800</u>
Contingencies	<u>218,200</u>
TOTAL CONSTRUCTION COST	\$1,620,000

Typical Section

Scale: 1" = 4' Hor. & Vert.

Prop Pressure Conduit and Auxiliary Storm Drain
(Shaw's Cove & north in the vicinity of Pumping Station)



AREA = $\frac{(12.5)(19 ft)}{27 CY/4F} = 8.8 CY/4F$

Project SHAW'S CREEK U.P.A

Sheet 15 of 19

Computed By R.D.N.

Checked By _____

Date 2/25/15

Field Book Ref. _____

Other Refs. Pressure Conduit

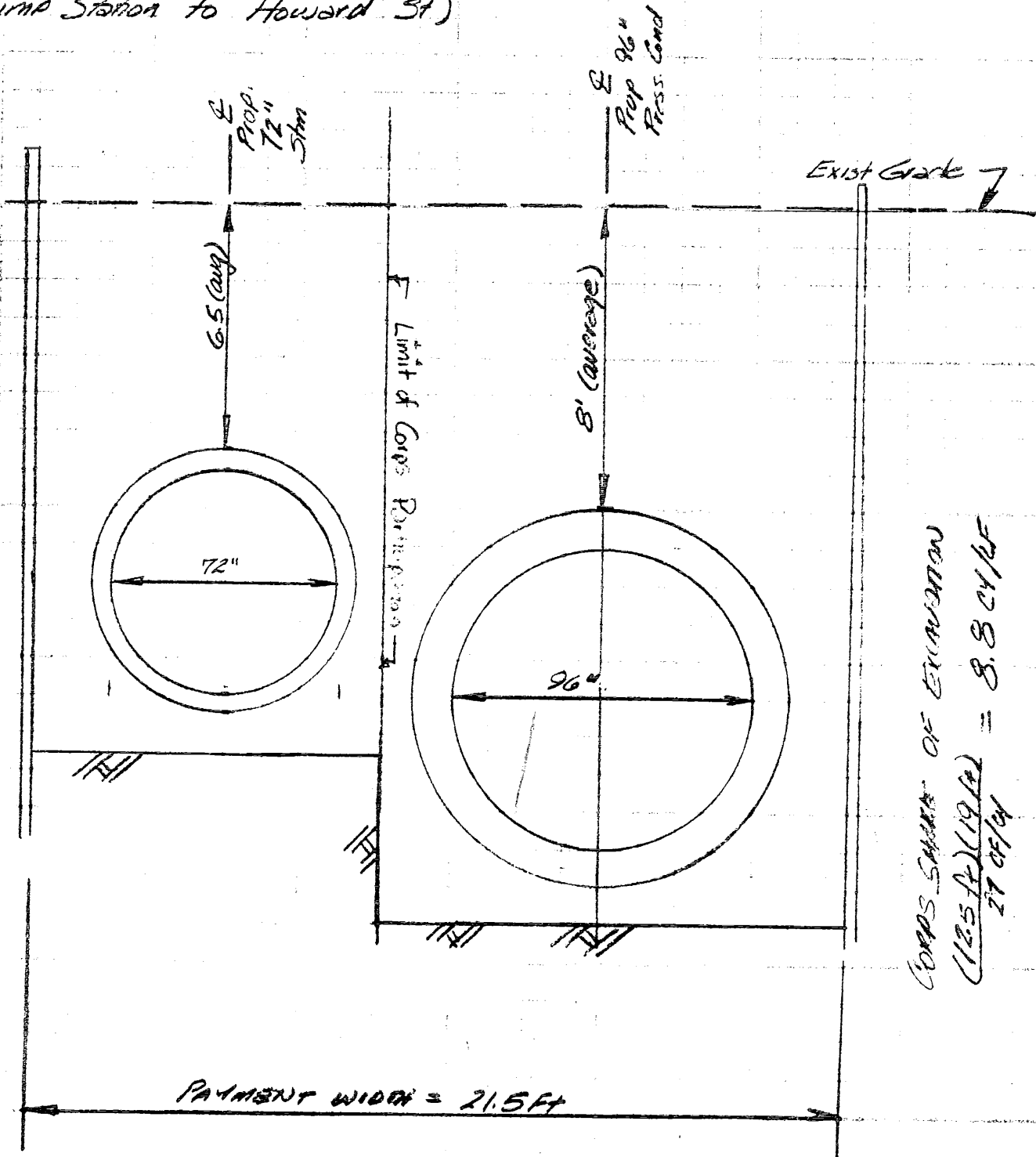
Revisions _____

SI-2
CE 11 110 AB

TYPICAL SECTION

Scale: 1" = 4'
H&V

Prop Pressure Conduit & Auxiliary Storm Drain
(Pump Station to Howard St)



Corps Share of Excavation
 $\frac{(12.5 ft)(19 ft)}{27 cft/lf} = 8.8 cft/lf$

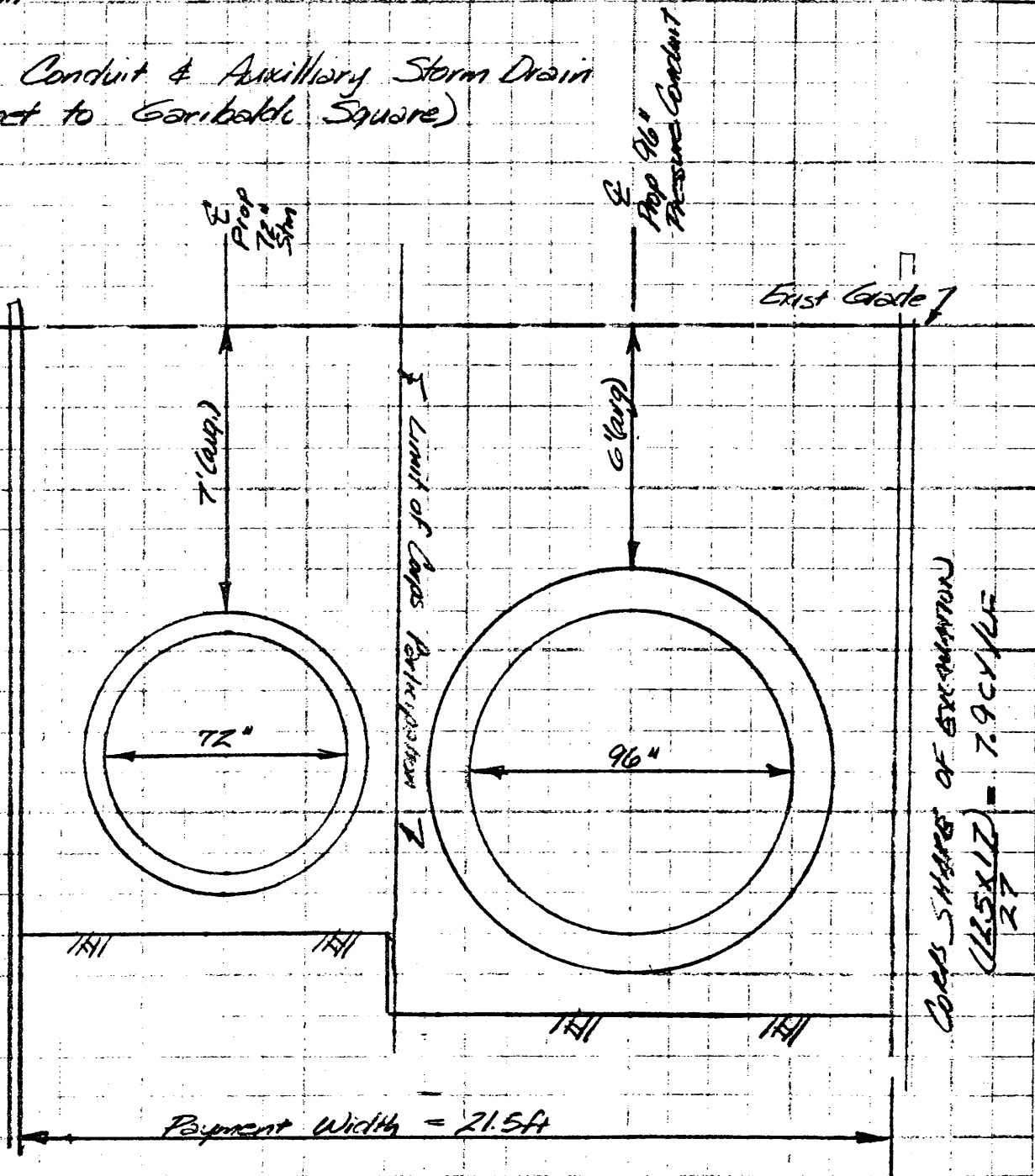
$$Area = \frac{(21.5 ft)(14.5 ft) + (4.5 ft)(12.5 ft)}{27 cft/lf} = 13.7 cft/lf$$

6781

Typical Section

Scale: 1" = 4' H&V

Prop Pressure Conduit & Auxiliary Storm Drain
 (Howard Street to Garibaldi Square)



$$\text{AREA} = \frac{(21.5\text{ft})(15\text{ft}) + (11.5\text{ft})(2.0\text{ft})}{27\text{CY/LF}} = 12.8 \text{ CY/LF}$$

15782

CORR SHAFTS OF EXCAVATION
 $\frac{(12.5 \times 1.7)}{2.7} = 7.9 \text{ CY/LF}$

Project SHAW'S COVE U.P.A.

Sheet 17 of 19

Computed By R.D.N

Checked By _____

Date 2/25/75

Field Book Ref. _____

Other Refs. Pressure Conduit

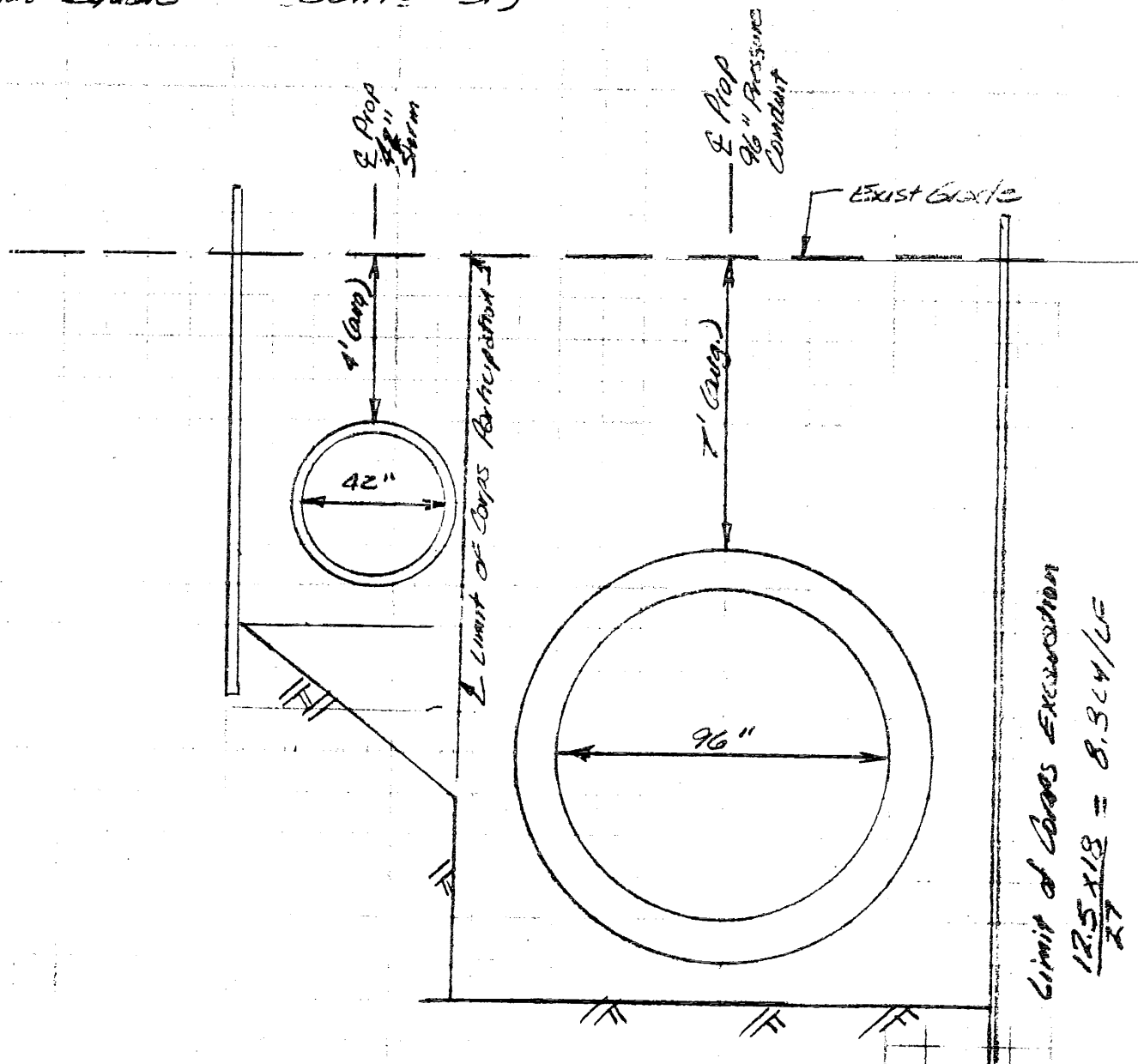
Revisions _____

52-2
CE 11110 AB

Scale: 1" = 4'
H#V

TYPICAL SECTION

PROP PRESSURE CONDUIT & AUXILIARY STORM DRAIN
(Garibaldi Square & Bank St)



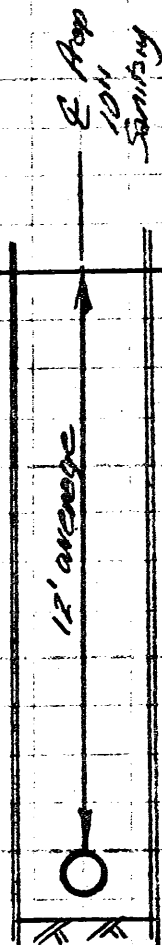
$$\text{AREA} = \frac{(18\text{ft} \times 11\text{ft}) + (13\text{ft})(7\text{ft})}{27\text{CY/LF}} = 10.7\text{ CY/LF}$$

3842

Project SHAW'S COVE W.R.A.
 Computed By R.D.N. Checked By _____
 Field Book Ref. _____ Other Refs. Pressure Pipe
SI-2
CE11110AB

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 Date 2/25/75
 Revisions _____
 Scale: 1" = 4' V&H.

Prop 10" Sanitary Sewer in Bank St



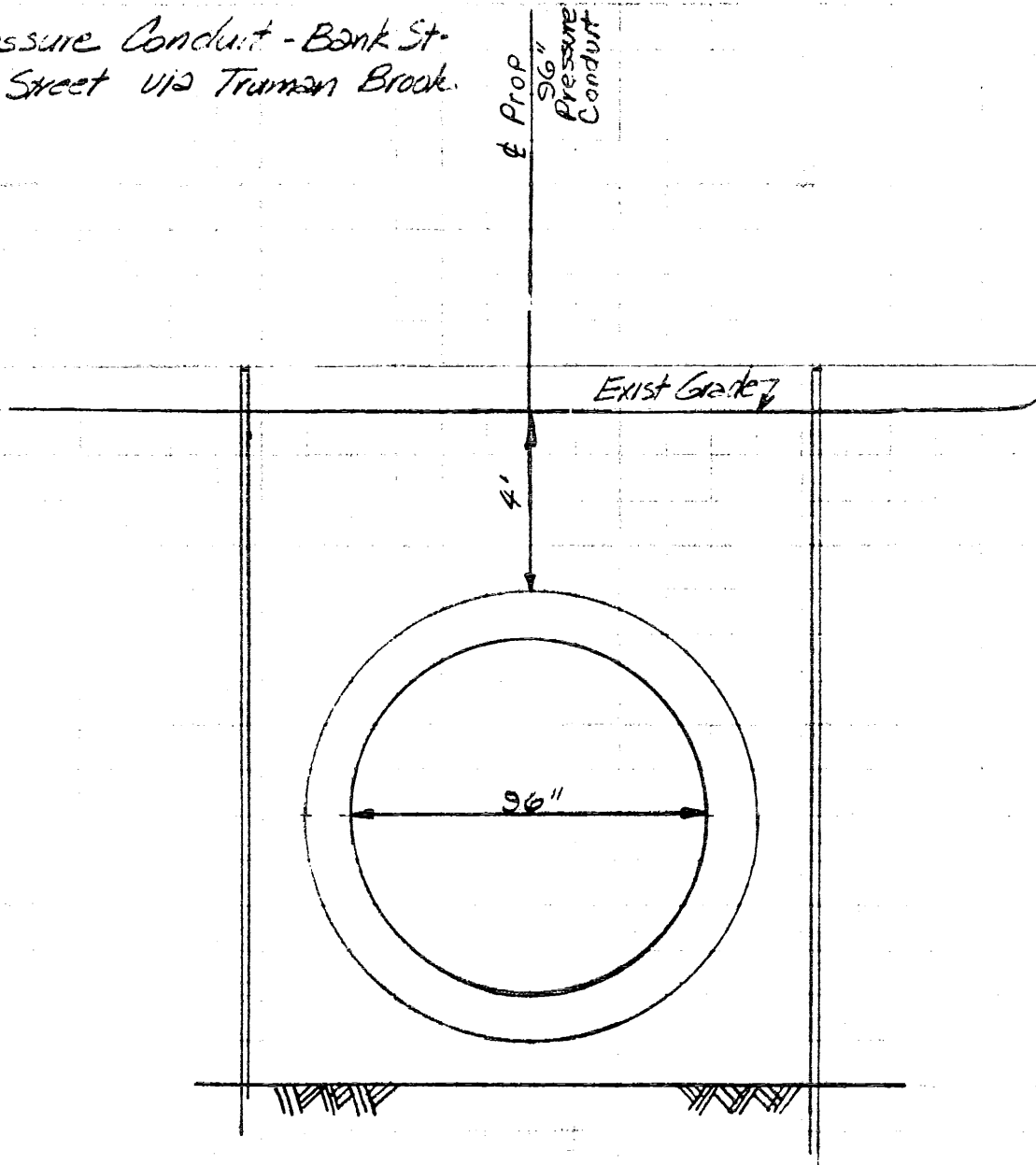
$$\text{Area} = \frac{(13.5\text{ft})(3\text{ft})}{27\text{cf/cy}} = 1.5\text{cy/LF}$$

291

Project SHAW'S COVE U.P.A.
 Computed By B.R.T. Checked By PR
 Field Book Ref. _____ Other Refs. PRESSURE CONDUIT
SI-2
CE 1110 AB

Sheet 19 of 19
 Date 11/11/76
 Revisions _____
 SCALE: 1" = 4' V. & H.

Prop. Pressure Conduit - Bank St.
 Grand Street via Truman Brook.



$$\text{Area} = \frac{(15 \text{ ft}) (12.5 \text{ ft})}{27 \text{ CF/CY}} = 7 \text{ CY/LF}$$

2070